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THE DEFENSE IN-HOUSE LABORATORIES

by . . . E. M. Glass

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Management Analysis Report . . .

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Office of the Director of Defense Research and Engineering
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FOREWORD

The Center for Strategic and International Studies at Georgetown University is conducting a broad study on "U.S. R&D Management." This report was prepared to review the issues pertaining to the Defense in-house laboratories and provide a historical perspective for the period 1961-1970. This review covers the problems identified, the actions taken, the problems that are still evident, and the various options available to make these organizations more effective.

The interpretation of historical events given here and the options described are presented to stimulate discussion and dialogue concerning the important matter of in-house governmental laboratories. As such, they do not necessarily coincide with the official views of the Department of Defense.

Acknowledgments

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1. INTRODUCTION

In order that the Department of Defense in-house laboratories may be profitably discussed, it is important that the role of the organization they serve be properly understood.

The Department of Defense (DoD) was created by the National Security Act of 1947 (61 Stat. 495) to succeed the National Military Establishment. Since that time, major amendments to the Act have been made. Of particular interest was the Department of Defense Reorganization Act of 1958 (72 Stat. 514), which was approved 6 August 1958. The DoD is part of a comprehensive program designed to provide for the security of the United States through the establishment of integrated policies and procedures for the departments, agencies and functions of the government relating to national security. Its functions are as follows:

(1) To support and defend the Constitution of the United States against all enemies, foreign and domestic.

(2) To ensure, by timely and effective military action, the security of the United States, its possessions and areas vital to its interest.

(3) To uphold and advance the national policies and interest of the United States.

(4) To safeguard the internal security of the United States.

The purpose of the DoD's research and development (R&D) arm is to maintain an "assured destruction" capability as a deterrent to major wars and the ability to deter or contain limited wars. Defense R&D must be flexible enough to react rapidly to the moves and countermoves of our adversaries and to take immediate advantage of new advances in science and technology. To meet military R&D needs, new technology, techniques, weapons and systems are required, together with a high degree of interaction between technology and operations.

Defense-Supported Institutions

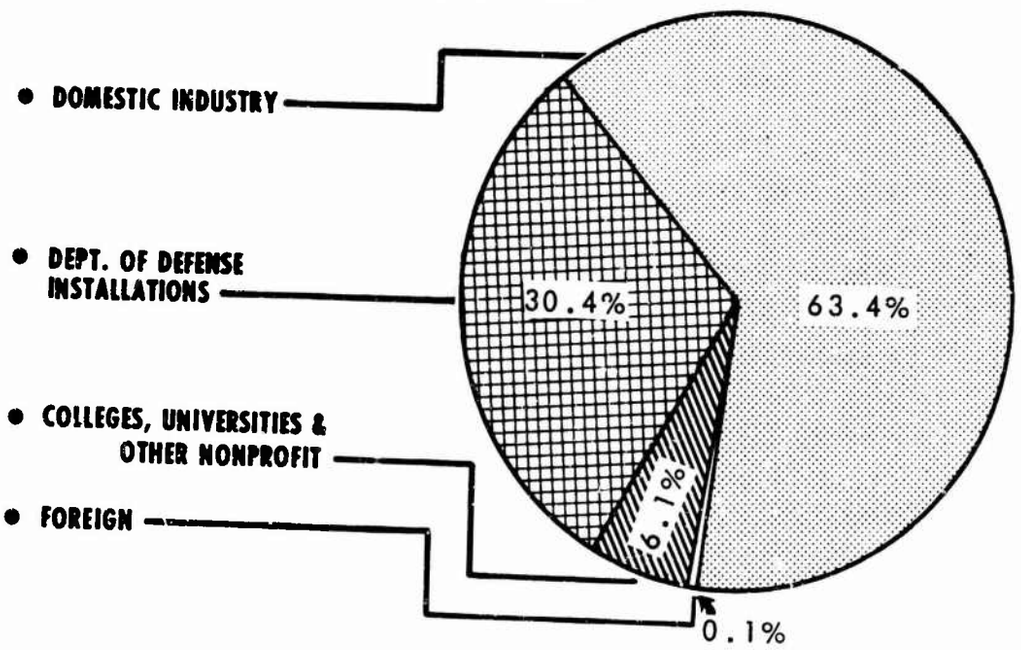
If it is to maintain the most flexible and imaginative posture, the DoD must utilize every conceivable resource, capability and contribution it can possibly attract, motivate and support, including the competence and services of all types of institutions--industrial, academic, nonprofit and in-house. Each of these organizations has a relatively unique although not exclusive role to play. They are important, interrelated, synergetic subsystems whose products of new knowledge, designs and weaponry are the first-line technological defense against foreseeable threats.

Figure 1

FY 1969

DEPARTMENT OF DEFENSE RDT&E OBLIGATIONS, BY PERFORMER

TOTAL $ 7.8 BILLION



The strategy of utilizing this mix of performers has been one of the unique and productive characteristics of the DoD's research, development, test and evaluation (RDT&E) program.

As shown in Figure 1, these organizations received the following proportions of the FY 1969 Defense RDT&E appropriation: industrial--about 63 percent; educational and nonprofit--about 6 percent; and in-house--slightly above 30 percent. Although the dynamics of Defense RDT&E activity has resulted in many programmatic and budget changes, there have been no major shifts in the relative balance of support for these institutions during the past 3 or 4 years in terms of either funding or staff level.

The types of institutions that perform RDT&E for the DoD and the criteria for selecting such performers were best summarized in the Bell Report as follows:

> Direct Federal operations, such as the governmental laboratory, enjoy a close and continuing relationship to the agency they serve which permits maximum responsiveness to the needs of that agency and a maximum sense of sharing the mission of the agency. Such operations accordingly have a natural advantage in conducting research, feasibility studies, developmental and analytical work, user tests and evaluations which directly support the management functions of the agency. Furthermore, an agency-operated research and development installation may provide a useful source of technical management personnel for its sponsor. . . .

(Examples: Army's Harry Diamond Laboratories, Naval Ordnance Laboratory, Air Force Materials Laboratory.)

> Colleges and universities have a long tradition in basic research. The processes of graduate education and basic research have long been closely associated, and reinforce each other in many ways. This unique intellectual environment has proven to be highly conducive to successful undirected and creative research by highly skilled specialists. Such research is not amenable to management control by adherence to firm schedules, well-defined objectives, or pre-determined methods of work. In the colleges and universities graduate education and basic research constitute an effective means of introducing future research workers to their fields in direct association with experienced people in those fields, and in an atmosphere of active research work. Applied research appropriate to the universities is that which broadly advances the state of the art.

University-associated research centers are well suited to basic or applied research for which the facilities are so large and expensive that the research acquire. the character of a major program best carried out in an entity apart from the regular academic organization. Research in such centers often benefits from the active participation of university scientists. At the same time the sponsoring university (and sometimes other cooperating universities) benefits from increased opportunities for research by its faculties and graduate students.[1]

(Examples: Lincoln Laboratories, Massachusetts Institute of Technology; Applied Physics Laboratory, The Johns Hopkins University.)

Not-for-profit organizations (other than universities and contractor-operated Government facilities), if strongly led, can provide a degree of independence, both from Government and from the commercial market, which may make them particularly useful as a source of objective analytical advice and technical services. These organizations have on occasion provided an important means for establishing a competent research organization for a particular task more rapidly than could have been possible within the less flexible administrative requirements of the Government.[2]

(Examples: Institute for Defense Analyses, RAND Corporation, MITRE Corporation.)

Contractor-operated Government facilities appear to be effective, in some instances, in securing competent scientific and technical personnel to perform research and development work where very complex and costly facilities are required and the Government desires to maintain control of those facilities. Under such arrangements, it has been possible for the Government to retain most of the controls inherent in direct Federal operations, while at the same time gaining many of the advantages of flexibility with respect to staffing, organization and management, which are inherent in university and industrial operations.

(Examples: Arnold Air Development Center (ARO, Inc.), Oak Ridge National Laboratory (Union Carbide).)

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[1]The DoD calls both university-associated research centers and not-for-profit organizations (other than universities and contractor-operated government facilities) Federal Contract Research Centers (FCRCs), and the National Science Foundation calls them Federally Funded Research and Development Centers.

[2]Ibid.

2. CHARACTERISTICS OF DEFENSE LABORATORIES

A popular notion of a laboratory as a place enclosed by four walls and populated by men and women in white coats is obviously too narrow and restrictive a definition. In fields such as oceanography, deep-submergence ocean activities, terrestrial sciences and atmospheric physics, the natural environments provide the setting for R&D work. The broad-ranging facilities now required to carry out sophisticated R&D in support of Defense and space activities have given new dimensions and properties to the word "laboratory."

The Defense laboratories seem to be involved in almost the entire spectrum of RDT&E, from the fundamental end, as represented by the Air Force's Cambridge Research Laboratories, through the technology-oriented organizations such as the Army's Electronics R&D Laboratories and encompassing such development organizations as the Naval Weapons Center at China Lake, California (formerly the Naval Ordnance Test Station), and the Naval Ordnance Laboratory at White Oak, Maryland. Generally excluded by this definition, however, are test and evaluation centers like the Army's Dugway Proving Ground, the Naval Air Test Station and the National Test Ranges.

Table I is a statistical summary of Defense RDT&E field activities (that is, excluding headquarters organizations) for the fiscal years 1967-69. In FY 1969, there was a cash flow of $4.2 billion from all DoD appropriations, of which only 62 percent was allocated from the RDT&E portion. Research and technology represent only 31.3 percent of RDT&E funds obligated by these field organizations; the remainder is utilized to support hardware development programs. In their staffing, there is almost a 3:1 ratio of civilians to military and almost a 4:1 ratio of civilian professionals to military professionals.

Although the overall funding of these organizations--RDT&E, procurement, operations and maintenance--had increased 13 percent during these three years, the allocation of RDT&E funds has remained fairly constant. Data for FY 1970 are not available, but it is anticipated that both categories will begin to decline.

There is a slight downward trend in research and technology (R&D categories 6.1 and 6.2) which is compensated for by a slight rise in the funding of development and management and support categories. The overall personnel level has declined, but the number of civilian professionals has increased. This has been accompanied by a reduction in no-degree professionals and an increase in holders of advanced degrees. In numbers, M.S. degrees went up 23.4 percent; doctorates, 20 percent; published papers, 4.4 percent; and patent applications, 7.5 percent.

The distribution of Defense RDT&E activities in 11 functional areas is summarized in Table II. Of the 124 organizations shown, the medical

TABLE I. STATISTICAL SUMMARY OF DEFENSE RDT&E ACTIVITIES

Data	FY 1967		FY 1968		FY 1969	
	$/#	%	$/#	%	$/#	%
Funds ($ million)						
Total	3,726		3,549		4,209	
In-house	1,943		1,934		2,090	
Contract	1,783		1,615		2,119	
RDT&E Funds ($ millions)						
Total	2,737	100.0%	2,541	100.0%	2,615	100.0%
In-house	1,345		1,335		1,382	
Contract	1,392		1,205		1,232	
6.1 Research						
Total	233	8.5%	235	9.2%	194	7.4%
In-house	130		140		143	
6.2 Exploratory Devel.	Total					
Total	717	26.2	598	23.5	625	23.9
In-house	343		363		361	
6.3 Advanced Devel.						
Total	330	12.1	318	12.5	351	13.4
In-house	105		117		119	
6.4 Engineering Devel.						
Total	279	10.2	287	11.3	310	11.8
In-house	109		129		129	
6.5 Management and Support						
Total	726	26.5	686	27.0	751	28.7
In-house	405		367		418	
Operational Systems Devel.						
Total	213	7.8	212	8.3	195	7.5
In-house	119		134		130	
Other						
Total	238	8.7	203	8.0	187	7.3
In-house	132		85		82	
Personnel (No.)						
Total military	35,781		34,983		33,271	
Professional	7,139	100.0%	7,017	100.0%	7,469	100.0%
No degree	1,462	20.5	789	11.2	1,151	15.4
B.S.	3,215	45.0	3,640	51.9	3,541	47.4
M.S.	1,402	19.6	1,487	21.2	1,679	22.5
Ph.D.	1,060	14.8	1,101	15.7	1,098	14.7
Total civilian	89,519		93,277		89,001	
Professional	25,314	100.0%	27,663	100.0%	28,902	100.0%
No degree	1,928	7.6	1,885	6.8	1,703	5.9
B.S.	17,046	67.3	18,519	66.9	19,445	67.3
M.S.	4,256	16.8	4,961	17.9	5,253	18.2
Ph.D.	2,084	8.2	2,298	8.3	2,501	8.7
Land (000 acres)	4,212		7,022		7,363	
Space (000 sq ft)						
Total	105,478		99,231		94,295	
Laboratory	30,747		30,542		29,881	
Administration	9,883		9,414		9,169	
Other	64,847		59,275		55,246	
Property ($ millions)						
Total	6,013		6,063		6,268	
Real property	2,940		2,990		3,358	
Equipment	3,074		3,072		2,910	
Patent applications (No.)	*		1,223		1,315	
Papers published (No.)	*		4,181		4,364	
Reports published (No.)	*		12,476		13,569	

Note: *Data for FY 1967 are not available.

laboratories represent 25.0 percent, but owing to their small size are staffed by 3.9 percent of the civilian professional population. Test and evaluation organizations are a close second in number (22.6 percent), but receive 27.7 percent of the RDT&E funds and over 50 percent of the total funds allocated to field activities. Organizations dealing with conventional ordnance are a distant third in number (12.1 percent), but employ 27.6 percent of the civilian professionals, and receive 19.4 percent of the RDT&E funds.

TABLE II. DISTRIBUTION OF RDT&E ACTIVITIES BY FUNCTION
(FY 1968 Data)

Functional type	No.	Percent of Total	RDT&E Funds (% of total)	Civilian Professionals (% of total)
Test and evaluation	28	22.6%	27.7%	14.0%
Ordnance	15	12.1	19.4	27.6
Electronics	5	4.0	15.8	12.8
Aerospace	11	8.9	13.0	10.5
Research	6	4.8	6.0	7.4
Sea warfare	3	2.4	5.0	9.1
Chemistry, biology, nuclear physics	8	6.4	4.9	5.0
Medicine	31	25.0	2.6	3.9
Materials and misc.	6	4.8	2.3	3.4
Engineering	5	4.0	2.3	4.0
Personnel, behavioral sciences	6	4.8	0.9	2.3
Totals	124	99.8%	99.9%	100.0%

Figure 2

Distribution of DoD Scientists and Engineers, by Field of Highest Degree

Army	Navy	Air Force	FIELD OF DEGREE
54.1%	55.2%	58.0%	ENGINEERING
13.7	21.3	15.7	PHYSICS
9.0	10.6	9.5	MATH. & STATISTICS
10.8	5.7	5.8	CHEMISTRY
4.5	0.9	1.6	LIFE SCIENCES - OTHER
1.8	2.3	3.0	SOCIAL SCIENCES & PSYCH.
2.2	1.9	2.7	ALL OTHER FIELDS
2.2	1.6	2.9	OTHER PHYSICAL SCIENCES
1.8	0.5	0.7	LIFE SCIENCES - HEALTH

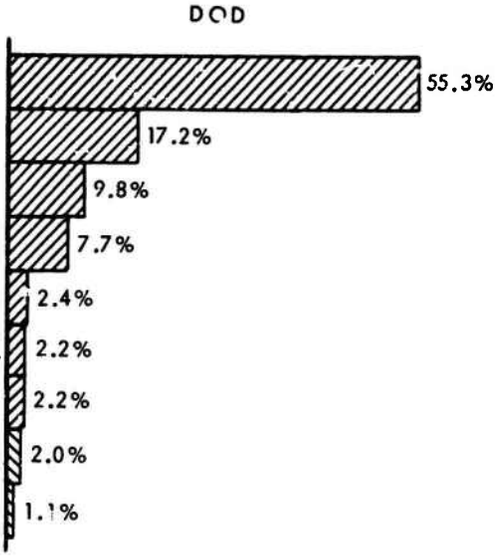
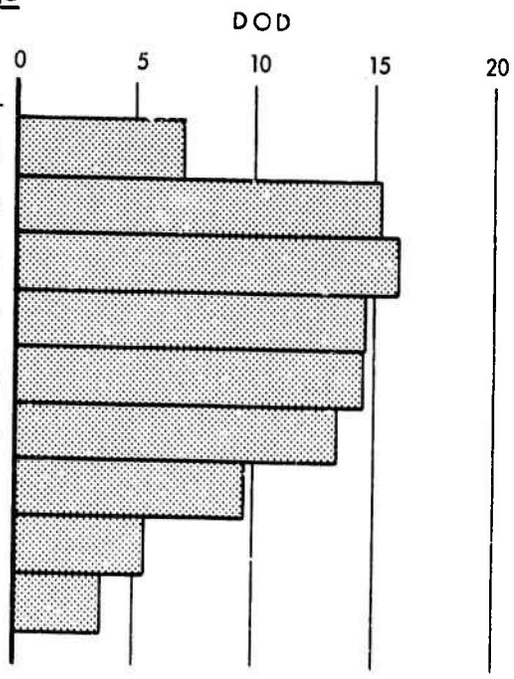


Figure 3

Distribution of DoD Scientists and Engineers, by Age

Army	Navy	Air Force	AGE GROUP (Years)
5.4%	10.2%	3.8%	20 - 24
13.0	19.2	11.0	25 - 29
15.8	15.5	17.2	30 - 34
13.9	14.0	18.2	35 - 39
16.2	12.8	14.9	40 - 44
14.1	12.1	14.8	45 - 49
10.4	8.8	10.5	50 - 54
6.5	4.8	5.6	55 - 59
4.8	2.6	3.9	60+



According to Figure 2, engineers represent the largest proportion (55.3 percent) of the civilian professionals, while engineers, physicists and mathematicians, combined, constitute 82.3 percent of the technical people.

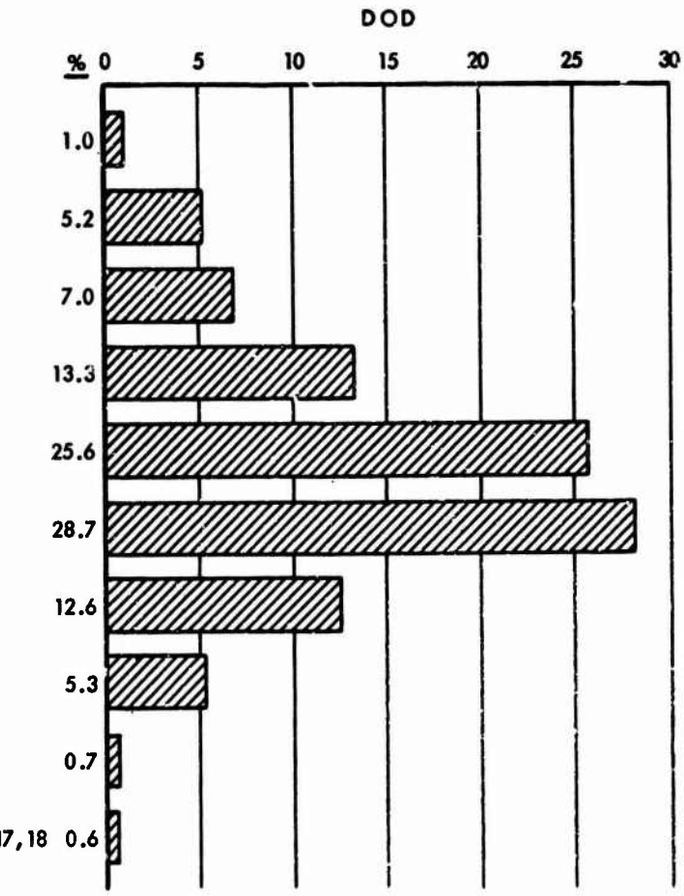
The age distribution of both supervisory and nonsupervisory professionals is shown in Figure 3. The median age is 38.9 years. Of the total sample, 22.3 percent are below 30 years of age and 38.3 percent are below 35, while 19.0 percent are over 50.

The grade distribution (see Figure 4) reveals that more than 50 percent of the civilians are at or below grade GS-12. The median grade is GS-12. Over half are GS-12s and GS-13s, and about one-fifth are at GS-14 or above.

Figure 4

Distribution of DoD Scientists and Engineers, by Grade

Army	Navy	Air Force	GRADE	%
1.4	0.8	0.8	GS-5	1.0
4.2	6.9	3.5	GS-7	5.2
6.8	8.4	4.1	GS-9	7.0
14.1	15.4	6.8	GS-11	13.3
26.3	26.7	21.6	GS-12	25.6
27.6	26.1	36.9	GS-13	28.7
13.0	10.2	17.1	GS-14	12.6
5.7	4.1	7.2	GS-15	5.3
0.4	0.8	1.2	GS-16	0.7
0.6	0.5	0.9	PL + GS-17, 18	0.6



GENERAL SALARY SCHEDULE (12-80)

	Rates Within Grade									
GS	1	2	3	4	5	6	7	8	9	10
1	$4,125	$4,262	$4,399	$4,536	$4,673	$4,810	$4,947	$5,084	$5,221	$5,358
2	4,621	4,775	4,929	5,083	5,237	5,391	5,545	5,699	5,853	6,007
3	5,212	5,386	5,560	5,734	5,908	6,082	6,256	6,430	6,604	6,778
4	5,853	6,048	6,243	6,438	6,633	6,828	7,023	7,218	7,413	7,608
5	6,548	6,766	6,984	7,202	7,420	7,638	7,856	8,074	8,292	8,510
6	7,294	7,537	7,780	8,023	8,266	8,509	8,752	8,995	9,238	9,481
7	8,098	8,368	8,638	8,908	9,178	9,448	9,718	9,988	10,258	10,528
8	8,956	9,255	9,554	9,853	10,152	10,451	10,750	11,049	11,348	11,647
9	9,881	10,210	10,539	10,868	11,197	11,526	11,855	12,184	12,513	12,842
10	10,869	11,231	11,593	11,955	12,317	12,679	13,041	13,403	13,765	14,127
11	11,905	12,302	12,699	13,096	13,493	13,890	14,287	14,684	15,081	15,478
12	14,192	14,665	15,138	15,611	16,084	16,557	17,030	17,503	17,976	18,449
13	16,760	17,319	17,878	18,437	18,996	19,555	20,114	20,673	21,232	21,791
14	19,643	20,298	20,953	21,608	22,263	22,918	23,573	24,228	24,883	25,538
15	22,885	23,648	24,411	25,174	25,937	26,700	27,463	28,226	28,989	29,752
16	26,547	27,432	28,317	29,202	30,087	30,972	31,857	32,742	33,627	
17	30,714	31,738	32,762	33,786	34,810					
18	35,505									

3. IMAGE OF DEFENSE LABORATORIES

Probably no class of institution has been studied and analyzed, praised and criticized, organized and reorganized to the degree that has been the lot of the Defense laboratories. This is a subject that attracts many experts, but it seems to be difficult for them to find areas of agreement. This lack of consensus may result partly from a condition familiar to us from the tale of the blind men and the elephant; that is, each study group sees only a portion of the whole laboratory system, either because of its specialized interests or because, for DoD purposes, "laboratory" has not been adequately defined.

The contributions of laboratories to military technology and weapons development are many and varied. They include the Sidewinder, Shrike and Walleye missiles, thermal batteries, proximity fuzes, fluid amplifiers, caseless ammunition, irradiated foods and the heart pump. More recently, in support of Southeast Asia operations, developments such as antimalarial drugs, night vision devices, the 175-mm artillery system, frozen blood and antipersonnel weapons such as the Gravel mine have added significantly to the U.S. military capability.

In spite of these impressive achievements, there has been a persistent feeling on the part of many prominent committees and individuals that in-house laboratories are the weakest and least effective of the performers available to do RDT&E for the Department of Defense. Much of this is based upon the general conception of the civil service system. The image of a technical career in the Federal Government has been pretty bad. As a rule, outsiders see a lack of challenging work and initiative, too little recognition, stifling bureaucracy and mountains of paper work and red tape. They also view the laboratories as being deeply imbedded within an organizational matrix, with no continuing chain of command from the bench to the policy-making level. As a result, they feel that too many procedures, controls and administrative devices, which are more appropriate and effective for operational and logistical organizations, are being misapplied to these R&D organizations.

On the other hand, most objective critics will admit that there are several outstanding Defense laboratories that could compete technically in almost any environment. These include, to name several from each Military Department, the Army's Harry Diamond Laboratories, the Walter Reed Army Institute of Research, the Naval Research Laboratory, the Naval Weapons Center (China Lake), and the Air Force's Cambridge Research Laboratory and Materials Laboratory.

4. HISTORICAL PERSPECTIVE

In a broad sense, governmental in-house laboratories can be traced as far back as the 1790s and the origin of the Springfield Armory. The traditional arsenal system was reinforced legislatively (10 U.S. Code 4532) during World War I when it was stipulated that the Secretary of War should have his supplies "made in factories or arsenals owned by the United States, so far as those factories or arsenals can make those supplies on an economical basis."

While emphasizing production, the arsenal system maintained an in-house capability to perform R&D as well as manage and technically direct private contractors. The system fostered the government's independence from the interests of private industry in evaluating and managing contracts and in advising Defense decision-makers. Traditionally, in-house organizations performed the technical functions involved in developing military materiel through the prototype stage, at which time the items were turned over to industry for quantity production.

Aircraft development, with its rapidly changing pattern in the late 1920s and early 1930s, was the first major area to break away from the traditional mode. It was not until the beginning of World War II that industry and the university were brought in as major R&D performers because of the need for extraordinary assistance in that crucial period. After the war, this broadened use of contractors continued. When the "missile race" began in the middle 1950s, the use of contract performers expanded again, when the so-called special nonprofit organizations emerged as valuable sources of technical know-how and principal contributors in the age of increasing weapon complexity and sophistication.

Studies of Laboratory Problems

This trend toward greater dependence upon contract performers was viewed with alarm by the President's Science Advisory Committee in a report issued in 1958 which stated:

> . . . some government researchers have tended to lose heart as the number of contract operated laboratories has grown over the last decade. Government laboratories are vital national assets whose activities will need to keep pace with the growing magnitude of federal research and development programs. Undue reliance on outside laboratories in placing new work of large scientific interest and challenge could greatly impair the morale and vitality of needed government laboratories.(27)

While the 1950s saw the decline of in-house laboratories as viable and purposeful organizations, the 1960s became the decade of their resurgence within a more balanced structure of Defense performers. As

noted before, the Bell Report in 1962 represented a major effort to define more clearly the roles of the various Defense performers.

During the last decade, there was consistent high-level emphasis within the government on improving the effectiveness of the in-house laboratories in carrying out their missions. This emphasis was based on the Bell Report, the DoD Task 97 Report and the "Competition for Quality" reports of the Federal Council for Science and Technology in the early 1960s. These reports highlighted the need for laboratories of high quality, as well as solutions to the problems that were seriously hampering the ability of the laboratories to effectively and efficiently accomplish their missions. A consensus was developing on the role of Defense in-house laboratories. Dr. Harold Brown, Director of Defense Research and Engineering from 1961 to 1965, defined their role as follows:

> First, the in-house laboratories should form a spearhead which must provide the Armed Forces with at least two essential services. (a) They must continuously investigate rapidly changing fields of science and engineering to find materials, techniques, processes and ideas which may prove to have some as yet undetermined military value. (b) In the course of their investigations in the fields of advanced technology, the Defense scientists and engineers must bring the problems of the Armed Forces before the broad scientific and technical community expressed in the terms of technical discourse.
>
> Second, DoD requires objective scientific and engineering advice on contract research and development programs. Most of the Defense RDT&E funds are expended on contract. The advice of the Defense laboratories is critical not only because advice which is sensitive to the Government's interests generally must be available to management, but because that advice must be particularly sensitive to the needs of the military users. It is axiomatic that it takes a long time to develop a sensitivity for the needs of the using forces.
>
> Third, laboratories are needed to manage or help manage weapons system development and test programs. Experience has been a harsh teacher. It is not always wise or economical to try either to have a large project directed by a military user who does not understand whether what he wants is feasible, or to let the contractor be his own director, or to set up a small management office without technical support. Often an organization with its own--even limited--development capability is required to secure effective management.

> Fourth, in-house laboratories are needed as an essential part of the system of technical education for military officers. Without the actual experience of working in the laboratory it will not be possible to develop the cadres of technically proficient officers required for the operation of modern, rapidly changing armed forces and for the understanding needed to set military requirements in a military situation in many ways unrelated to any previous one.

In a similar vein, the Bell Report concluded:

> We regard it as axiomatic that policy decisions respecting the Government's research and development programs--decisions concerning the types of work to be undertaken when, whom, and at what cost--must be made by full-time Government officials clearly responsible to the President and to the Congress. Furthermore, such officials must be in a position to supervise the execution of work undertaken, and to evaluate the results. These are basic functions of management which cannot be transferred to any contractor if we are to have proper accountability for the performance of public functions and for the use of public funds.

Thus it clearly defined a function that gave real purpose and meaning to in-house laboratories and could not be delegated to outside organizations.

In addition to the Bell Report, the basic policies governing the in-house DoD laboratories are contained in a Secretary of Defense memorandum dated 14 October 1961, and have been stated by the Director of Defense Research and Engineering in appearances before congressional committees, in public speeches, and in memoranda to the Military Departments. Generally these policies affirm the need for strong in-house organizations capable of spearheading Defense RDT&E programs. In-house capability at the staff level was defined as "the technical competence to understand proposals, to evaluate them, and to make technical decisions about them." In-house capability of the laboratories was defined as "the ability to actually do, or at least to begin, a development program."

When Mr. McNamara became Secretary of Defense in 1961, he asked 120 questions to provide the basis for the future posture of the Department of Defense. Question 97 was: Advise me ways in which to improve the operations of the in-house laboratories. To answer this question and to develop solutions to problems identified, "Task 97" was established.

The members of Task 97 visited many laboratories, talked to many people, and turned in a report which was endorsed by Mr. McNamara on

14 October 1961. In doing so, he reiterated the importance of the in-house laboratories to the DoD's mission and proposed a number of positive actions by the Military Departments to upgrade their in-house capabilities. Out of this came--

(1) A sensible approach to taking full advantage of the provisions of P.L. 313 and a more rational approach to compensation rates for top-level technical people under this authority.

(2) The establishment of a Laboratory Director's Fund to support work judged by the laboratory director to be promising or important, with only after-the-fact review by higher authority.

(3) The pinpointing of responsibilities with the Assistant Secretaries (R&D) of the Military Departments for the health and environment of the in-house laboratories.

Other recommended actions, however, were not implemented as fully. These included: (1) Using DoD in-house laboratories as a primary means of carrying out Defense programs; (2) delegating greater decision-making authority to the laboratory directors; (3) solving the many administrative difficulties that prevented laboratories from being as effective as they should be; and (4) establishing clear lines of technical management and responsibility for each in-house laboratory.

On 30 March 1963, Dr. Harold Brown reconstituted Task 97 as the "Task 97 Action Group" in recognition of the fact that strengthening the in-house laboratories "is not only a matter of study but one of action." Its concept of operation was to establish a core of permanent members, generally six, who were responsible for its continuing operation. These members were from the DDR&E's staff and from the offices of the Assistant Secretaries (R&D) of the Military Departments. Other members, problem-area specialists, were to be added in accordance with the problem being examined. Further, every level of management was represented in all visits to laboratories so that, as a problem was raised, one could follow it up the chain of command on the spot and either obtain an immediate solution or find a basis for designating an individual for action. It also provided a rare opportunity to communicate the rationale behind many decisions to the people directly affected, the laboratory personnel.

The Task 97 Action Group dealt with many administrative problems affecting the creative climate of laboratories. Several examples of the actions that resulted from the activities of the Group are:

. Important information, based upon specific examples, was provided to the Civil Service Commission, and thus directly influenced many features of the Salary Reform Act of 1962 and subsequent legislation.

. Some relief from gold-flow restrictions was obtained for laboratories in securing foreign periodicals and scientific equipment.

. Security review of scientific papers was delegated to the laboratory level.

. New policies relating to air-conditioning equipment for laboratories, i.e., treating them the same as any other type of technical equipment, were established.

. There was more favorable interpretation of the Government Employees Training Act, 7 July 1958, particularly in regard to the restrictions on the 1-year-in-10 rule.

. The need for some relief from the rigid manpower ceilings to enhance training and career development was dramatized. This is now represented by central pools of manpower spaces and dollars to support technical training without hampering laboratory operations.

. Block funding, or core funding, of Air Force laboratories in research and exploratory development.

During 1964 it became increasingly apparent that the task-force approach to handling "the laboratory problem" had about run its course. A consensus developed to the effect that the in-house laboratories lacked meaningful problems, management stability and prominence, and recognition and that they failed to impact at the highest policy levels. While administrative improvements were valuable and should be diligently sought, they were not considered, in themselves, sufficient to make laboratories effective tools of the organizations they serve.

In the latter part of 1964, there evolved a new concept designed to produce fundamental changes in the DoD in-house laboratories, of which the following were salient features:

(1) The proposed reorientation of the larger Defense laboratories toward military problem areas or military missions (e.g., anti-submarine warfare (ASW), battlefield communications, air-to-ground warfare, etc.).

(2) The proposed elimination of echelons between the Military Departments' Assistant Secretaries (R&D) and the principal mission-oriented laboratories, through the establishment of a new technical line management structure headed by a Director of Laboratories with requisite authority to provide the proper environment for Departmental R&D.

(3) A proposal that the laboratories encompass the full spectrum of R&D activities (from research through operational systems development) with respect to a military problem area. They would be given (a) greater local authority over decisions in the areas of research and exploratory and advanced development and (b) greater responsibility for providing technical assistance and advice in engineering and operational system development to organizations that develop and acquire weapon systems.

On 20 November 1964, the Secretary of Defense forwarded this plan to the Military Departments and asked that they work out the implementation of "some such plan in each of the Military Departments." During 1965 there was a considerable exchange of ideas and detailed study of approaches that were compatible with each Department's mode of operation.

It was during this period that the positions titled Director of Laboratories were assigned to all three Departments to provide laboratory representation at a high policy-making level. This step alone had an excellent effect on the morale and contributions of in-house laboratory personnel. It created an opportunity for the important interaction between high-level decision-makers and the technical specialists in the laboratories.

In 1966 a new team took over under the new DDR&E, Dr. John S. Foster, Jr. Attention naturally was directed to the health and productivity of in-house laboratories. The conclusions reached as a result of reviewing the situation were:

(1) Many laboratories have not been involved in the overall weapon-planning process and other urgent military problems.

(2) The laboratory structure was too fragmented to take on meaningful programs in an integrated way.

(3) The labs did not have the administrative flexibility to respond rapidly to changing needs, the changing state of technology and the changing nature of new tasks.

An overall strategy was developed for dealing with these questions by the following means:

. Assigning important military missions and weapon-planning responsibilities to major laboratories.

. Taking steps to reorganize fragmented activities into more cohesive structures.

. Identifying and solving administrative problems that lower the effectiveness of the Defense laboratories.

5. THE WEAPON CENTER CONCEPT

Although conceived in 1964, the idea of establishing large weapon centers to embrace broadly conceived technical programs did not win acceptance until 1966, after it was endorsed by the Defense Science Board (DSB) and the President's Science Advisory Committee (PSAC). The important characteristics of a weapon center as defined by the DSB are as follows:

(1) It would be oriented toward a military mission or a military problem.

(2) The number of professional scientists and engineers would be of the order of 1,000 or more, so as to achieve a "critical mass."

(3) The weapon center, which may have more than one geographical location, would be a self-contained organization in that it would perform research and development with feasibility models as the end product. These models should be capable of demonstrating proof of function in a military situation.

(4) The director of the center would have direct control over all the resources required, such as funding, manpower and facilities; and he would report at a sufficiently high level that echelon "layering" would be minimum.

(5) About 70 percent of the professional personnel would be devoted to creative in-house engineering. Although contracts would be awarded, the fundamental development engineering would be accomplished within the center.

(6) The weapon center's specialists would participate in the determination of military requirements associated with its mission.

(7) The center would be involved in the initial procurement of equipments and would provide support to the procurement agency when large-scale production is achieved.

(8) The overall performance of the center would be critically evaluated on a periodic basis to guarantee that the center is a competitive organization with high performance standards and achievements.

There are advantages to creating weapon centers by combining the capabilities of certain laboratories already engaged in developing components and subsystems. A number of them are listed below:

(1) It would enable concentration on the identification and solution of critical military problems.

(2) It would provide opportunities for Government engineers to work more effectively on important military problems, and would help to better orient specialists responsible for areas of technical disciplines.

(3) Clear responsibility would be delegated to the weapon center.

(4) The combined mission--discipline approach would enable the center to serve as a quick-reaction facility and to be particularly responsive to war needs.

(5) There would be opportunity to arrive at optimum solutions to problems independently of technical-specialty biases. (The systems approach could be more readily applied.)

(6) It would be much easier to evaluate the center's performance, because end products that are clearly the responsibility of the center could be tested and evaluated.

Naturally, there are also some disadvantages:

(1) Penalties in the form of cost, political effects, time delays, personnel attrition, etc., may be excessive because of a fundamental change in organizational concept.

(2) There could be difficulties in arriving at acceptable mission statements.

(3) There could be a tendency toward monopoly and overprotection.

(4) In the event that one or more weapon centers were created, there would still be a requirement for a management system to handle technical specialties.

The willingness of the Military Departments to adopt this concept has varied considerably. The Army and Navy have traditionally done more in-house development work than the Air Force. Thus, it is not surprising that the Navy has transformed its total laboratory complex along these lines and that the Army has started significant actions in a similar direction. On the other hand, the Air Force laboratories have traditionally concentrated on research and technology, the responsibility for hardware development being assigned to other organizational

components that interact with industry. The Air Force has elected to make no organizational changes aimed at adopting this concept.

5.1 Creation of Weapon Centers

Some new weapon centers have been established with clear and broad responsibilities over a number of military problems and functional areas. They have been given important assignments in threat analysis and the development of requirements; planning for future systems; assessment of the vulnerability of proposed major systems; and important active roles in the research and development cycle. These weapon centers are emerging as important sources of technical judgment and advice to top-level planners and decision-makers. Here are several examples:

Naval Underseas R&D Center (NURDC)--Created from the Naval Ordnance Test Station (NOTS) at Pasadena, together with elements of NOTS at China Lake, the Navy Electronics Laboratory, and an ASW Analysis Group from the Naval Ordnance Laboratory (NOL) at White Oak, the NURDC is responsible for overall ASW systems analysis, hardware development for surface systems, systems integration of air, surface and subsurface systems, and fleet engineering support. Because of the importance of ASW, three principal Navy centers are focusing on aspects of that program: The Naval Air Development Center (Johnsville, Pennsylvania) has responsibility for airborne ASW systems. The Naval Underwater Weapons R&D Station (Newport, Rhode Island) has recently been combined with the Naval Underwater Sound Laboratory (New London, Connecticut) to form a new center for the development of subsurface ASW systems.

Naval Ship R&D Center (NSRDC)--Three Navy laboratories, the David Taylor Model Basin, the Marine Engineering Laboratory, and the Mine Defense Laboratory, have been combined organizationally to form the NSRDC, which is responsible for advanced ships' concepts, high-speed ships, and deep-ocean vehicles from research to project formulation.

Army Air Mobility Center--Two Army activities, the Aviation Materials Laboratory and the Aeronautical Research Laboratory, have been combined to form the nucleus of an Air Mobility Center that is responsible for the development of aircraft and related components and equipment. A unique characteristic of this center is its colocation with NASA's Langley, Ames and Lewis Research Centers to minimize the need for duplicating expensive facilities.

5.2 Consolidation and Closure of R&D Activities

In addition to the creation of major functional weapon centers, there has been a considerable amount of restructuring, consolidation and closure of R&D activities with a view to creating the needed capability to attack complex military problems. Examples are as follows:

The Army is in the first stages of a long-range plan to modernize and consolidate its medical activities, reducing their number from

14 to 6. The plan calls for establishing three primary centers, in the Eastern, Central and Western United States. The Army Materials and Mechanics Research Center has been created from eight fragmented R&D activities. Deseret and Dugway Proving Grounds have been combined in a new Deseret Test Center in Utah, while sharp cutbacks have been announced for Fort Detrick as a result of changed national policy regarding biological weapons.

The Navy has extensively consolidated its R&D activities to accommodate the creation of the two new weapon centers described before. In addition, the Aeronautical Engineering Laboratory of the Naval Air Engineering Center (Philadelphia, Pennsylvania) has been incorporated in the newly established Naval Air Propulsion Test Center in Trenton, New Jersey. Two Navy R&D installations have been deactivated--the Naval Air Mine Defense Unit (Panama City, Florida) and the Naval Supply R&D Laboratory (Bayonne, New Jersey). In 1969 the closing or reduction of three other laboratories was announced--the Naval Radiological Defense Laboratory (San Francisco, California), the Naval Ordnance Laboratory (Corono, California), and the Naval Applied Sciences Laboratory (Brooklyn, New York).

The Air Force has closed the Arctic Aeromedical Laboratory (Fort Wainwright, Alaska) and a number of RDT&E activities at Holloman Air Force Base, New Mexico.

Laboratory restructuring actions in the past two years are summarized in Table III.

TABLE III. RECENT RESTRUCTURING OF LABORATORIES

Department	No. of closures announced	No. of major consolidations and reductions	No. of personnel spaces reduced	Savings ($ millions)
Army	2	4	1,176	19.42
Navy	5	6	924	17.71
Air Force	3	2	1,212	1.27
Total	10	12	2,221	38.40

Thus we have seen a major realignment of Defense laboratories over the past decade, aimed at making the laboratory system more effective and productive.

6. ADMINISTRATION OF LABORATORIES

Most of the analysts who have examined the Federal in-house laboratory structure in the past agree that three major causes of the weaknesses or difficulties of these organizations are:

(1) Pay and professional benefits;
(2) Lack of challenging assignments and personal recognition;
(3) The arbitrary use of bureaucratic regulations, with resulting frustrations and inhibiting effects.

They consider that the cumulative effects are statistical rather than individual, since there are many unique cases in which productive laboratories and capable, outstanding scientists and engineers have learned how to cope with "the system."

Probably more effort has gone into the identification and solution of administrative problems than into any other facet of in-house laboratory management. In improving laboratory operations, the major objective has been to achieve the degree of flexibility that characterizes the high-technology organizations in the private sector.

Since most of the problems were "people oriented," it was natural for the Department of Defense to join forces with the Civil Service Commission (CSC) in studying them. A critical survey of 47 key Defense laboratories revealed that most of their problems were not inherent in the civil service system but rather were the result of narrow interpretation and misapplication of CSC rules and regulations. Procedures, controls and administrative devices that are effective for operational and logistical organizations were being applied arbitrarily to R&D organizations. For some time, special provisions within the Federal personnel system have been available to satisfy the unique needs of creative people and activities, but they have been inadequately used. DoD management just has not taken advantage of these solutions to long-standing problems. A listing of laboratory problems identified by the CSC is given in Appendix I.

As a result of this joint CSC-DoD effort, major improvements in the organizational climate of in-house laboratories have been achieved, or instituted, even though a number of major gaps remain, particularly in the areas of personnel and manpower. Especially in huge organizations, however, progress in these areas is generally slow. Improving the administrative climate of a large group of laboratories imbedded in an even larger complex requires sustained high-level attention over a long period of time.

Some improvements have been made over a broad spectrum of personnel problems--from recruitment, career development and training, personnel

mobility and compensation to dealings with marginal employees. Non-personnel problems that have been attacked include those related to supporting services, resource flexibility, facility modification, procurement, supply, and laboratory maintenance.

Examples of some important steps taken are:

. A 2- to 3-year demonstration (Project REFLEX) has been established to test the hypothesis that the utilization of fiscal controls without numerical manpower controls is a more meaningful way to manage laboratories. This is an attempt to provide laboratory managers with the administrative tools to integrate people, program funds, facilities and equipment.

. The achievement of salary comparability with private industry and the broader application of authority to match salary offers of competitors has permitted DoD laboratories to become more competitive in recruitment. There has been significant improvement in their ability to attract first-class people to leadership positions by more rapid promotion and by the infusion of fresh blood from industry and the universities.

. Greater fiscal flexibility has been needed by the laboratories for some time in managing exploratory development (R&D category 6.2) to meet new technical opportunities and respond to urgent operational priorities. The Air Force has achieved this with a single budget line item per laboratory for its 6.2 program. The Navy has restructured its FY 1970 program to permit greater "block" funding of its laboratories. And the Army is conducting a 2-year experiment on single-line-item funding for three of its laboratories.

. Steps have been taken to enable greater mobility of R&D personnel. The Navy has adopted for its principal laboratory technical directors a single job description that will permit more broadly ranging assignments for them. The Army and Air Force are considering the adoption of similar concepts.

Overall, it is clear that significant progress has been achieved along well-conceived lines, but success in the administrative arena tends to be transitory. Continuing high-level attention is needed to sustain the flexibility gained. Past improvements have been the result of the high priority enjoyed by R&D. The recent disenchantment of the public with science and technology and the budgetary cutbacks in R&D, however, have already had their impact upon the momentum of reforms aimed at providing the optimum environment for laboratories. Success here will be much harder to come by in the current national climate.

7. BLUE RIBBON DEFENSE PANEL REPORT

The Blue Ribbon Defense Panel, chaired by Gilbert W. Fitzhugh, issued its report to the President and the Secretary of Defense on 1 July 1970. The Panel's conclusions with respect to Defense laboratories were as follows:

> Overall, the productivity of Defense in-house laboratories appears low compared to the very substantial investments in them. This is particularly true with respect to Army Laboratories, and those Army Laboratories connected with arsenals appear least productive.
>
> Defense Laboratories and test and evaluation centers are not organized in any systematic fashion. They are fragmented along technology lines with limited scope and responsibility.
>
> Consolidation of laboratories and centers to achieve a more nearly matched functional alignment with the scope of normal problem areas is very badly needed. Efforts at consolidation are being made but the rate of progress is far too slow.(7)

The report states that these organizations "suffer from a rigid personnel system which inhibits qualitative improvements to the technical staffs and fails to promote or move the more competent people into leadership positions."

On the one hand, the Panel is critical of the civil service system, which overemphasizes seniority rather than innovative productivity as the primary factor in promotions and reductions, in an environment of "arbitrary personnel ceilings and reductions." On the other hand, the report underlines the dangers of the observed common practice of appointing laboratory directors and assistant directors from outside the system. While this can provide a useful transfusion from the broader scientific and engineering community, the report concludes that it also removes incentive for career personnel--who therefore cannot aspire to higher than the third-level job in a laboratory.

The lack of a "workable mechanism for scientific and technical personnel to be moved freely within the Department" was cited as a problem. Such inflexibility of personnel assignment was mentioned as resulting in a high degree of stagnation, which is believed to be partly accountable for the relatively poor productivity of Defense laboratories.

Finally, a possible conflict-of-interest problem was identified relating to the DoD laboratories' role as both performer and contract administrator. As developers, the laboratories are considered to be in competition with private companies whose contracts they manage. The report cites "an inclination on the part of some laboratories to show

favor to products 'invented here' and to view very skeptically any products 'not invented here.'"

There are three major recommendations of the Panel that directly concern the Defense laboratories:

> The Advanced Research Projects Agency should be delegated the responsibility for all research and exploratory development budget categories. Funds for such research should be budgeted directly to this Agency, and the Agency should be authorized to assign or contract for work projects to laboratories of the Defense Department or in the private sector, as appropriate. . . .
>
> II-17 The Advanced Research Projects Agency (ARPA) and the Defense Test Agency (DTA) should be directed to make a joint review to determine which in-house defense laboratories and test and evaluation centers are essential to research and development needs of the Department with the goal of eliminating the nonessential ones, and consolidating (across Services) the remainder. . . .
>
> II-19 Close attention should be given to the possible advantages of having some of these laboratories and centers government-owned but contractor-operated.

On 26 August 1970, the Secretary of Defense announced the appointment of a DoD Blue Ribbon Action Committee to convert selected basic recommendations of the Blue Ribbon Defense Panel into operation as rapidly as possible. As of this writing, no specific actions have come out of this Committee's deliberations. Thus, it is not possible to evaluate the Panel report's impact on in-house laboratory management. Instead, the various options open to the DoD, if the recommendations of the Panel are taken seriously, will be discussed.

After almost nine years of a concerted effort to improve the climate and performance of in-house laboratories, the findings of the Blue Ribbon Defense Panel are somewhat depressing. Some people believe that, as long as in-house laboratories are organizationally imbedded deep within the Military Departments, efforts to achieve long-term improvements in laboratory operations are sure to fail. They feel that there is no way to protect the laboratories from the staggering overload of bureaucratic red tape and from diffuse, fragmented middle management levels that are apparently unable to delegate needed authority. On the other hand, many people believe that the close interaction of laboratories with their sponsors and their Department's needs would be unnecessarily perturbed if new organizational barriers were created.

8. OPTIONAL APPROACHES TO DEFENSE R&D ORGANIZATION

Five optional approaches to improving Defense R&D management and performance are described here.

8.1 Option I--Modified Status Quo

Retain existing organizational arrangements and relationships, but continue to press harder within the system to improve the climate and effectiveness of the in-house laboratories and to define more specifically their roles and output expectations. As an adjunct to this approach, establish a system of managing by tailored goals and objectives in terms as quantitative as possible. Under this option, develop a concept of using "tri-Service lead laboratories" across the Military Departments' organizational lines to improve inter-Service efforts, eliminate undesirable duplication of effort, and effect savings in funds and manpower.

8.2 Option II--Defense R&D Agency

With this approach, the Advanced Research Projects Agency (ARPA) could be transformed into a Defense R&D Agency (RADA). Under such an arrangement, its characteristics might be something like these:

RADA would consist of an Office of Defense Research and 8 to 10 centers tailored along mission or functional lines. It would be manned principally by civil service personnel, with a heavy sprinkling of technically trained officers flowing through the organization. This would provide some military operational insight and a source of R&D training for these officers. Also, by using tours of duty, civilians from within government and from industry and universities would be brought into RADA for specified periods of time to continually bring new ideas and concepts into the organization.

In creating RADA, only those Defense laboratories that meet rigid criteria of quality would be absorbed. If it were necessary to establish a high-priority function in RADA and no competent Defense laboratory existed, an entirely new organizational element would be created.

If a decision were made to transfer an existing Defense laboratory to RADA, that lab would continue in its current geographical location in order to eliminate the need for massive military construction. Over the years, however, an attempt should be made to recombine elements of centers and laboratories more centrally.

Further details concerning this option are contained in Appendix II. The pros and cons of option II follow.

Option II

Advantages:

1. High-level attention and support for R&D programs and a more uniform policy climate.

2. Possibility of a more cohesive program.

3. More effective management of R&D efforts, free from divisive pressures within the Departments.

4. Superb technical consulting staff to assist the DDR&E in program.

5. Reduced overlapping and duplication of functions.

6. Elimination of inter-Service competition for resources.

7. Reduction of large intermediate staffs and red tape.

8. Streamlined decision-making process.

9. Assurance of an improved R&D environment.

10. Significant savings in funds, manpower and facilities.

11. Attraction of higher quality people because of the agency's proximity to the policy level.

Disadvantages:

1. Loss of principal technical consultants and expertise from Departments.

2. Lessened responsiveness to Departments' needs and requirements.

3. Decreased acceptance by the Departments because of agency's high-level reporting and organizational separation.

4. More difficult communications and coupling with Departments' military organizations because of organizational barriers.

5. Diminished relevance of work owing to agency's organizational separation from Departments' planning functions and operational military organizations.

6. Removal of all responsibility for R&D from Departments, with the result that they would be only peripherally concerned with R&D, and that could be reflected negatively in their long-range planning and thinking.

7. Lowered quality of work because of the lack of competition in important areas.

Option II is based upon the assumption that management policies, program definition and funding would be at the corporate level, that is, in the Office of the Secretary of Defense (OSD). A modified version of that alternative is to permit the Departments to control a significant portion of the funding of RADA. By this mechanism, one could assure better coupling and maintain some semblance of competition in the form of multiple parallel efforts. Thus, through financial control, the Departments could more easily assure RADA's responsiveness to their needs by means of formal agreements or contractlike arrangements.

8.3 Option III--Higher Level Reporting in the Departments

In this option, the principal laboratories of each Military Department would report directly to the Departmental Assistant Secretary (R&D), and many of the features described in option II would be included.

Option III

Advantages	Disadvantages
1. All advantages of option II, particularly with respect to quality of management, improved R&D environment, effectiveness and cost reduction.	1. Decreased acceptance by lower level organizations within the Departments because of the high-level reporting and organizational separation of labs.
2. Provision of top-notch technical consulting staff to Assistant Secretaries (R&D) of Departments.	2. Less effective communications and coupling with military activities in the Departments because of organizational separation.
3. High-level attention and support and a more uniform policy climate for laboratory programs and problems.	3. Intensified military-civilian animosity and competition.
4. Greater acceptance by the Departments than under option II, as the labs would still be part of them.	
5. More meaningful and responsive interaction between laboratories and high-priority Departmental programs, plus more relevant R&D efforts than under option I; also, better interaction between military planners and operational people.	

8.4 Option IV--Defense Institutes Concept

During studies in late 1962, the Bureau of the Budget proposed the establishment of a government corporation, in the form of institutes, which could substitute at least partially for in-house organizations and Federal Contract Research Centers (FCRCs). The objective of such an instrumentality was to provide the essential degree of organizational autonomy and operating and financial flexibility that has been obtained by government corporations (e.g., Tennessee Valley Authority--TVA), while retaining effective public accountability and control. Such an institute was believed to be a means of reproducing within the government structure some of the more positive attributes of the nonprofit (FCRC) type of organization.

Appendix III is a draft bill, "Proposed Government Institutes Act," prepared by the Bureau of the Budget (BoB). A summary by the BoB Office of Management and Organization follows:

> In summary, the draft provides that each institute would be a Government corporation established by the President pursuant to general authority to be granted by the Congress. Each would be subject to the supervision of a Cabinet officer or agency head but would be a separate legal entity apart from the existing departments and agencies. As a separate entity directly managed by a board of regents appointed by the President, each institute would enjoy a considerable degree of independence in the conduct of its internal affairs. Appointed members of the board of regents would be persons eminent in the fields of science, engineering, research administration, education or public affairs. Each institute would have as its chief executive officer an executive director appointed by the President and would have such operating and financial flexibility as might be required for the effective conduct of its program. Institute employees would be Federal employees, but each institute could establish a compensation system based on the principle of comparability.
>
> The traditional pattern of Government organization is essentially authoritarian and derives in considerable degree from principles of organization developed by the military. Our usual objective in organizing Government programs is to provide precise assignments of responsibility and to establish clear lines of authority and accountability from the top to the bottom of the organization. We believe that these principles of organization are sound when applied to operating programs; but creative activities, such as research primarily concerned with the exploration of ideas and the pursuit of knowledge, do not thrive when confined within a rigid hierarchical structure.
>
> Study has shown that research is most effectively conducted within a "research environment." A research environment is the product of a number of elements, including the freedom to be creative, absence of excessive layers of supervisory management, reduction of "red tape" to the absolute minimum, and high quality professional leadership. It has been the difficulty of obtaining those conditions within the Government structure that has, in part, led to increasing reliance on contractors. The not-for-profit corporation has met a genuine need which Government installations cannot always fulfill satisfactorily.
>
> It is hoped that the Government institute would make it possible to provide the necessary research environment

within the Government and give the Government a wider range of choice in selecting the means for the conduct of research and development programs.

The institute would be designed primarily for the administration of research centers which are to be established on a permanent or semi-permanent basis, rather than organizations which are to go out of existence upon completion of a specific program. It is not contemplated that institutes would be used to the exclusion of not-for-profit contractors, or other types of Government installations, although it is conceivable that an institute could take over such facilities when such action is considered to be in the public interest.

Under this arrangement, it would be possible to create one government corporation to cover the total Defense R&D Agency. By federalizing the FCRCs, it would be possible to integrate them into the Agency and reduce manpower and costs to a greater degree.

Option IV

Advantages	Disadvantages
1. Most advantages of options II and III.	1. Most disadvantages of option II, particularly with respect to the corporation's responsiveness and relevance to the Departments' needs.
2. Since the corporation would be outside the civil service system, reduced problems regarding personnel and administration.	2. Conflict with the civil service system owing to establishment of such an elite group outside, but intimately involved with, the system.
3. Assurance of work's relevance by contractual arrangements between the corporation and the Departments.	3. Less effective communications and coupling with the Departments; probability that the Departments would attempt to maintain duplicative R&D organizations to ensure the availability of technical consultation and advice.
4. Greater efficiency because industrial management practices would be used.	
5. Less bureaucracy than in-house laboratories and greater responsibility to government than industry.	
6. Assuming a more flexible arrangement, the significant upgrading of technical staffs, programs and facilities; also a more attractive image to top scientists and engineers in the country.	

8.5 Option V--Reduction of In-House Laboratory Structure

This option would significantly reduce the Defense in-house laboratory structure, and would require the DoD to depend more heavily upon industrial, university and nonprofit organizations for its R&D. Under this arrangement, the in-house organizations would shrink to a size commensurate with the performance of functions for the Military Departments in situations for which nongovernmental operations are neither appropriate nor adequate. This would prevent the duplication of staffs and facilities already existing in the civilian economy, and would eliminate waste in manpower, facilities and resources.

Option V

Advantages	Disadvantages
1. Possibility of attracting higher quality staff and managers.	1. Lack of governmental expertise to evaluate contractors' proposals, operations and results.
2. Elimination of practically all civil service problems.	2. Significantly higher costs.
3. Reduction of governmental bureaucracy.	3. Larger channel of communications between user and producer, creating more difficulty in translating and communicating requirements.
4. Greater flexibility to meet large fluctuations in programs.	
5. More competitive environment for the Defense RDT&E program.	4. Lack of continuity of effort as contractors change.
6. Elimination of manpower and ceiling problems.	5. Escalation of problems relating to conflict of interests.

8.6 Option VI--Contract Laboratory Concept

Contractor-operated R&D organizations have offered unique benefits over the years, not only to the DoD but to other government agencies. The FCRCs and the National Laboratories of the Atomic Energy Commission are typical of this organizational concept.

Congressional acceptance of contractor-operated R&D organizations has been less than enthusiastic. Since about 1961, the House Committee on Appropriations (Mahon) has consistently criticized the use of FCRCs and has taken some action affecting them--or, at least, showed some recognition of the problem--each year. In general, especially during the earlier years, the criticism of the Mahon Committee has been directed against the Air Force FCRCs, in particular, the Aerospace Corporation.

Although the Mahon Committee questioned the desirability of the FCRCs' very existence during the early 1960s, their attitude changed to one of "understanding and appreciation" of the original need for them on the basis that the DoD could not marshal the scientific talent within its own structure "to accomplish the highly complicated effort within the short period of time available to meet national security objectives." During the FY 1966 hearings, however, the Committee felt that the growth and proliferation of what it called "premium priced" organizations had reached the point at which congressional action was indicated.

Since that time, the Mahon Committee and the Senate Armed Services Committee have registered their concern by major budget reductions and legislative restrictions that limit the flexibility of the FCRCs. Because of these actions--as well as other forces that are at work, especially the antimilitary sentiment in many universities--the number of FCRCs has diminished, and others are seeking ways to disassociate themselves from this class of organization. Congressional disenchantment with the Defense FCRCs, however, has not been reflected in the management of FCRCs working for other government agencies.

The DoD cannot consider expanding this type of organization unless it receives a clear commitment of support from the President and the Congress. If this were to occur, it would be possible (as in the case of the government corporation concept) to create an integrated contract operation that would encompass the efforts of both the traditional in-house laboratories and the FCRCs.

9. CONCLUSIONS

Regardless of the option chosen by the Department of Defense, it is clear that the in-house laboratories must be able to adapt and employ the flexible and progressive management techniques that are more typical of private industry. The most crucial of the primary questions concerning in-house laboratories are:

(1) The choice of problems, their significance, and the feasibility of finding solutions through research and development.

(2) The creation of flexible capabilities in the laboratories that can, in fact, solve the most difficult problems.

(3) The translation of results of the laboratories' work into action or application.

The organizational climate of the laboratories is the key to success. The existence of a restrictive, overmanaged laboratory system without meaningful purpose is incompatible with effective performance. A number of studies, both in-house and outside, have attempted to outline the conditions most favorable to maximizing the effectiveness of available R&D talent and organizations. Probably the most pertinent and informative summation was developed by Holst, et al., in "The Basic Requirements for Maximizing Effectiveness," in response to the Bell Report. They presented the key basic elements as follows:

- Reputation and atmosphere
- Excellence of staff and its direction
- Importance of facilities and support
- Clarity, challenge and urgency of objectives
- Maintenance of professional caliber of operations
- Professional leadership by professionals
- Professional recognition and encouragement
- Encouragement and support of freedom of inquiry and method
- Advancement on merit
- Absence of unproductive regulations and reports

Appendix IV contains the pertinent extract.

One major reason for the continual criticism of in-house laboratories over the years has been the failure of management at all levels to pay sufficient attention to these critical factors. The very characteristics the DoD has demanded of its contract performers have been totally or in part denied its in-house performers. Unless the environmental conditions most essential to maximum efficiency in R&D are dealt with squarely by the DoD, it really doesn't matter what the organizational structures or relationships are, for the Department's in-house capability will remain the weakest link in the Defense chain.

As a general rule, Defense laboratories have not been evaluated and criticized with respect to what they are permitted to do by the "system" or on the basis of the roles and missions assigned to them by their agencies. Instead, criticisms relate more to what they ought to be doing in terms of greater contributions to critical Defense needs. Since the laboratories in many respects are not masters of their own destiny, the results of such appraisals are more an indictment of overall RDT&E management practices and policies than of laboratory management per se. What is really lacking is an overall strategy for Defense laboratories.

Success in most endeavors has been the result of setting goals and placing some sort of priorities on them. By using the stimulus of goal setting, it has been possible to make advances that would not otherwise have been attained. McConkey defines this concept as "management by results"(32). Haggerty calls this system of management "OST--Objectives, Strategies and Tactics"(30).

Instead of trying to relate organizational effectiveness to some generalized model, or set of criteria, this approach encompasses the establishment of tailored goals and objectives which are reasonably specific to a particular organization or group of organizations. It must begin at the top of the hierarchy and become increasingly specific and quantitative through the various levels of management(29,31).

Anderson has proposed a broad set of goals and objectives to be applied across the total spectrum of Defense laboratories(33). (Excerpts from his paper are presented in Appendix V.) These objectives are more in the form of principles than specific steps proposed to solve identified problems. If some such long-range objectives can be agreed on at the top levels of management in the Department of Defense and the Military Departments, they could form the basis of a meaningful long-range DoD strategy for laboratories. It would then be possible to develop specific, time-phased goals aimed at solving the problems and facing the critical issues that are evident in the management of in-house organizations. Once these goals are mutually understood, effective implementation on a decentralized basis would be possible.

The Defense in-house laboratory system is extremely complex, with many organizational interfaces and relationships. The management difficulties are well recognized, and require continuing emphasis and attention. The energies of top management must be focused on "Where do we want to go?" and "What do we want to achieve?" If this situation can be realized, then the Defense in-house laboratories can reach new levels of effectivenss and productivity.

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APPENDIX I

PERSONNEL PROBLEMS AND RECOMMENDATIONS

OF

THE CIVIL SERVICE COMMISSION

Note: The 15 most important problems are marked by a star in the left-hand margin.

Problem	Action Agent	Recommended Action
1.1 COORDINATING WORK LOAD, FUNDS, AND MANPOWER: Work load, funds, and manpower are furnished to laboratories by separate sources that are not coordinated. This reduces the responsiveness of the laboratories and their ability to manage programs subject to dynamic change. Coping with multiple, uncoordinated controls requires an inordinate amount of the time and attention of top-level laboratory management that should be applied to the technical program.	DoD Army Navy AF	The DoD, working with the Military Departments, should improve the coordination of work load, funds, and manpower. The laboratories should be allowed greater flexibility of operation under a less fragmented, better coordinated control system. Among changes that should be considered are the following: - Increased delegation of authority for manpower, organization, and personnel management to laboratory directors. - Delegation to laboratory directors of authority to make exceptions in particular circumstances to manpower ceilings, grade, and organizational control procedures. - Substitution of fiscal budgets (for in-house work) for present manpower ceiling controls. - Use of man-year accounting during the fiscal year. - Common DoD manpower control procedures for RDT&E activities.
	Army Navy AF Labs	As an interim measure, significant increases in work load and funds, without increases in manpower authorizations, should be made only on approval of the Director of Laboratories after review with local laboratory management. (See also item 1.1b in the report.)
1.1a Manpower Controls: Administrative arrangements for manpower and personnel space control delay processing of personnel actions and inhibit the matching of work load, manpower, and funds.	Army	The Table of Distribution and Allowances system of the Department of the Army, as now applied, is inappropriate for RDT&E organizations. It underlies many of the local laboratory management problems. Unless improvements can be made to give greater authority and flexibility of operation at the laboratory level, the use of the system for RDT&E activities should be eliminated.
	AF	The Department of the Air Force should improve the timeliness and responsiveness of the Systems Command manpower and organizational control system. Care should be exercised in applying engineered manpower standards to RDT&E activities. Initial application of the standards should be treated as a research project with laboratory management participation in their study.
1.1b Work Assignments, Funds, and Manpower: Lack of coordination of work assignments, funds, and manpower limits the effectiveness of laboratory efforts to manage programs subject to dynamic changes.	DoD Army Navy AF	See item 1.1.
1.1c Overtime Limitations: Limitations on use of overtime inhibit the effectiveness of organizations having short lead-time schedule changes and work requirements, such as at the White Sands Missile Range.	Army Navy	Departments should explore the use of selective systems for controlling overtime that take into account the particular needs of RDT&E activities, especially those at the White Sands Missile Range and the Naval Weapons Center, Corona, which cited this problem.

	Problem	Action Agent	Recommended Action
	1.1d Across-the-Board Cuts in Personnel: Across-the board cuts in personnel based on "productivity assessments" are incompatible with laboratory-type operations.	Army	Productivity cuts, in principle, are incompatible with an expanding-technology and level-of-effort manpower ceiling. They should not be assessed against the in-house laboratories.
*	1.1e Authority To Reprogram Funds: Laboratories have limited authority to reprogram funds to meet new work situations. This reduces the laboratories' ability to carry through research and exploratory development and to utilize fully their resources.	Army Navy	The Departments of the Army and the Navy should consider delegating authority to laboratory management to reprogram funds for research and exploratory development (6.1 and 6.2 element funds).
	1.2 MAINTAINING A RESPONSIVE AND PRODUCTIVE ORGANIZATIONAL STRUCTURE		
*	1.2a Organizational Controls: The Army's Table of Distribution and Allowances inhibits laboratory efforts to maintain a responsive and productive organizational structure.	Army	See item 1.1a.
	1.2b Application of the Dual Career Ladder Concept: The dual career ladder concept (two-track system for classifying research positions), while generally receiving wide use, is receiving limited use in certain Army RDT&E activities.	Army	The Department of the Army should determine (1) whether limitations have been placed on the use of the two-track system and (2) whether its use is inhibited through misunderstandings by servicing personnel and manpower organizations. If limitations or misunderstandings are found, they should be eliminated.
*	1.2c Establishment and Filling of GS-14 and GS-15 Positions: Numerical limitations and delays in acting on the establishment of GS-14 and GS-15 positions have inhibited laboratory efforts to recruit skilled professionals and to place the laboratories' own personnel at proper levels.	Army Navy AF	The Military Departments should eliminate special controls for high-grade (GS-14 and 15) positions in the laboratories. Post-audit reviews should be used to check on laboratory use of delegated authority to establish and fill positions.
	1.2d Balance of In-House and Contract Efforts: Assignment and funding of projects without accompanying allocations of manpower spaces limit in-house research capability and motivate dependence on contracts. The existing balance of in-house and contract efforts largely reflects the uncoordinated demands and controls on laboratories.	Army Navy AF	Funds, manpower, and project assignments should be coordinated so as to achieve the desired balance of in-house and contract programs in each laboratory. Procedures should be established to ensure that decisions on the proper balance are based on judgments by the Director of Laboratories and local laboratory management. (See also item 1.1.)

Problem	Action Agent	Recommended Action
1.3 ESTABLISHING AND FILLING PUBLIC LAW 313 AND NON-QUOTA SUPERGRADE POSITIONS: The length of time (average of 150 to 180 days for the three Services) required to obtain approval of requests for establishment or changes to non-quota supergrade and Public Law 313 positions is excessive. The delays have reduced local management's ability (1) to compete successfully for quality talent at this level and (2) to recognize and compensate senior staff members for their responsibilities and contributions in a timely manner.	Army Navy AF	The Departments should institute rapid review systems. Changes should include the following: - Eliminate some of the intermediate levels of review. - Center responsibility for review at each level. - Confine before-the-fact review to persons and organizations making substantive decisions on program content, position classification, and qualification of candidates. - Make after-the-fact reviews for other purposes, e.g., to administer numerical controls. - Ensure that any internally imposed information requirements are specifically stated. - Bring to the attention of the Civil Service Commission any externally imposed requirements that cause significant delays.
1.4 RECRUITING TECHNICAL PERSONNEL		
1.4a Cooperative Educational Programs: Laboratories are experiencing difficulties in carrying out effective cooperative educational programs because of:		
Manpower space limitations: Laboratories are finding it increasingly difficult to devote limited manpower spaces to cooperative programs.	DoD	The DoD should consider expanding the pool of manpower spaces for long-term training to include cooperative education in order to provide the laboratories relief in the use of local resources for this investment in upgrading the organization.
	Army Navy	Additionally, the Departments of the Army and the Navy should employ man-year accounting (as opposed to monthly head counts and ceiling applications) to help solve this problem.
Inability to conclude working agreements with colleges.	Navy	The Department of the Navy should review the problems cited by the Naval Missile Center, Pt. Mugu, and the Naval Air Development Center, Johnsville; and, if existing regulations inhibit efforts to carry out a satisfactory program, the matter should be brought to the attention of the Commission.
Low pay for cooperative students, which results in low retention rate.	Army	The Missile Command, where the problem was cited, should explore with the Department of the Army the desirability of requesting the Civil Service Commission to approve higher local pay rates.
Inequities in health benefits for co-op students in schools operating on a quarterly basis.	CSC	The Civil Service Commission will investigate the problem, take corrective action as required, and report back to the Departments.

Problem	Action Agent	Recommended Action
1.4a (continued):		
Inability to make firm offers of appointment.	AF	The Department of the Air Force should review the problem cited by the School of Aerospace Medicine, Brooks Air Force Base, Texas, to determine whether full use is being made of existing authorities and flexibilities. If the matter cannot be resolved, it should be brought to the attention of the Civil Service Commission.
1.4b Laboratory Participation in Recruiting Programs: Certain laboratories within the Army Materiel Command believe that recruiting is overly centralized at the Command level. They desire more participation by their technical personnel in the recruiting, to visit more colleges than are now scheduled, and to have more intensive coverage than is now "permitted" by the AMC centralized scheduling.	Army	There are misunderstandings concerning the role of the laboratories and the laboratory R&D people in college recruiting at certain laboratories of the Army Materiel Command. The Department of the Army should ensure that misunderstandings are cleared up, that AMC regulations are not being applied more restrictively than intended, and that the laboratories are fully informed of their authorities in this area.
1.4c Timeliness and Effectiveness of Recruiting Efforts: The cumulative effect of manpower controls and personnel regulations, many of which require before-the-fact approval, reduces the timeliness and effectiveness of recruiting efforts.	Army Navy AF	The long-range solution is to decentralize administration of manpower and organization controls. (See items 1.1 and 1.2.)
*	Army Navy AF	As an interim solution, the Departments should authorize laboratory managers to establish a limited number of positions for uniquely qualified people without regard to space, high-grade limitations (through GS-15), and organizational limitations, but subject only to the usual position classification and merit promotion determinations at the local level. Overruns of regularly authorized personnel ceilings could be corrected by the laboratories through making personnel adjustments within a reasonable period thereafter.
	Labs	Laboratories (or their servicing personnel office) should negotiate with the servicing Interagency Board for authority to hire directly for positions where there are insufficient eligibles in either number or quality.
	Labs CSC	When needed, CSC regional offices have agreed to provide quick pre-audit service on laboratory requests to pay higher than minimum salary rates.

	Problem	Action Agent	Recommended Action
	1.4d Timeliness of Security Clearance Procedures: Certain laboratories have been inordinately delayed in making firm offers of appointment to candidates for scientific and engineering positions because of the time required for national agency checks (which are required for security clearances for noncritical sensitive positions). These delays inhibit the laboratories in competing for quality personnel.	Labs	Laboratories should make firm commitments for employment subject only to the individual's being suitable for security clearance.
		Labs	Where quick decisions are essential, more laboratories should establish procedures for bringing new employees on board prior to granting security clearances through temporary assignments to nonsensitive positions.
	In the Navy Department, current security clearances of applicants granted by a Defense Industrial Security Clearance Office are not accepted by the hiring activity, thus delaying employment and utilization of personnel.	Navy	The Department of the Navy should review its security clearance requirements to determine whether the clearance process can be expedited, without loss of control, by accepting clearance granted by Defense Industrial Security Clearance Offices.
*	1.5 REFERRING TECHNICAL EMPLOYEES FOR SERVICE-WIDE PLACEMENT: Agency referral systems delay filling of key laboratory positions without recognizable positive results.	Army	The Department of the Army should make certain that the career referral system provides quick reaction, for example, by issuing lists of candidates periodically in advance of need, and having system requirements met by laboratory consideration of candidates on the list. If quality candidates are not available through the system, the laboratories should be provided advance exception to its use.
		Navy	The Department of the Navy should ensure that its executive assignment system does not result in delays, does not undercut the laboratories' authority to select candidates, and does not inhibit laboratory efforts to recruit and fill key positions with quality talent from DoD and outside sources.
*	1.6 DEALING WITH THE MARGINAL EMPLOYEE: Some technical personnel have reached higher levels in RDT&E organizations than their capabilities warrant. Laboratory managers want improved management techniques and approaches to deal with the problem.	Labs CSC DoD Army Navy AF Labs	Authorities and flexibilities now provided by the Federal personnel system should be used more aggressively to deal with the problem. Consideration should be given to the desirability of the recommendations contained in the study by the Federal Council for Science and Technology, *Management and the Marginal Employee*, March 1966.
*	The one-year probationary period is too short to evaluate the professional performance of scientists and engineers.	Army Navy AF	The Military Departments should investigate the need for extending the probationary period for R&D personnel. They should determine the extent of use of the present one-year period and the expected effects of lengthening the period, on both the upgrading of the staff and on recruiting. The Commission should be informed of the results of the investigation
*	The Army provides much broader rights of appeal of	Army	

	Problem	Action Agent	Recommended Action
	1.6 (continued): dismissal during the probationary period than are provided by the Commission. Laboratory managers believe this has reduced the value of the probationary period.	Army	and the DoD recommendations. The Department of the Army should consider limiting the appeal rights of probationary employees to those established by the Civil Service Commission, unless it is shown conclusively that they are not adequate.
	1.7 UTILIZING THE TECHNICAL STAFF: The utilization of technical staff is limited by manpower limitations and administrative arrangements which result in (1) inadequate technician support of scientists and engineers, (2) inadequate personnel office support of some Air Force and Army laboratories that are tenants, and (3) inadequate administrative support in some Army laboratories.	Army Navy AF	Funds, manpower, and work load should be better coordinated, and manpower and organizational controls should be decentralized, as previously recommended.
*		Army AF	The Departments of the Army and the Air Force should determine the adequacy of personnel support provided RDT&E activities, and where not adequate, provide the service needed by (1) improving or changing the present arrangements for financing and staffing the consolidated offices or (2) providing laboratories with their own personnel offices—or in the case of small laboratories a deputy or assistant personnel officer who would oversee the laboratory's personnel support and provide competent advisory service to laboratory management.
		Army	The Department of the Army should reduce and simplify the administrative paper work of management and control systems, or adequate in-house administrative support of laboratory management should be authorized. Corrective measures should ensure that top-level laboratory personnel are not burdened with nonessential paper work.
	1.8 DEVELOPING AND RECOGNIZING THE TECHNICAL STAFF		
	1.8a Education and Training: The Navy central control of long-term training, as now applied, reduces the usefulness of the program. Delayed approvals complicate the implementation of the program.	Navy	The Department of the Navy should provide prompt review and action on requests from the laboratories for funds and spaces from the DoD Long-Term Training Pool. Similarly, prompt action should be taken on laboratory requests for authority to use local resources for long-term training.
	Two Air Force activities have had difficulty in providing part-time educational opportunities beyond the M.A. level.	AF	The Department of the Air Force should investigate the problem with the School of Aerospace Medicine and the 6570th Personnel Research Laboratory to determine whether all possibilities have been exhausted. Any remaining problem should be brought to the attention of the Civil Service Commission.

	Problem	Action Agent	Recommended Action
	1.8b Attendance at Scientific Meetings: In certain laboratories of the Departments of the Army and the Navy, travel to technical society meetings has been tightly restricted. The adverse effects have been disproportionate to the amount of funds involved.	Army Navy	Where not now provided, authority should be delegated to laboratory managers to review and control travel to professional meetings, subject to applicable guidelines covering travel for all purposes.
	1.8c Forms of Recognition Within Government: Forms of recognition for scientific and professional employees are not adequate.	DoD Army Navy AF	The DoD and the Departments should encourage the use of outstanding laboratory personnel on key scientific and policy committees.
*	2.1 MATCHING THE SALARY OFFERS OF COMPETITORS: Superior candidates at the B.S., M.S., and Ph.D. levels are difficult to recruit and retain because Government salary levels are not competitive with those of private industry. Similarly, salaries are not adequate to attract and retain sufficient top-quality management personnel.	CSC	Legislation increasing pay of Federal employees generally has been enacted. The legislation will provide additional flexibility in setting rates of pay for scientists and engineers.
*	2.2 PAYING TRAVEL EXPENSES FOR JOB INTERVIEWS: Candidates at all levels are more difficult to recruit because laboratories are unable to pay travel costs for interviews.	CSC	The Civil Service Commission is now supporting a legislative proposal to authorize agencies to pay travel costs for job interviews. The bill is now being considered by the Congress.
	2.3 PAYING HIGHER WITHIN-GRADE SALARY RATES: When recruiting superior quality candidates at the grade GS-11 and higher in a competitive market, an immediate decision on salary is sometimes essential. Laboratories are unable to make firm decisions on salary during the initial interview; Civil Service Commission approval is required on each case.	Army Navy AF	The Departments should inform the Commission of (1) the need for delegated authority to make exceptions to existing salary rates and (2) whether this authority would be further delegated to the laboratory level.
		CSC	Where rapid response is essential, the Civil Service Commission will provide prompt action on requests for paying higher within-grade salary rates (normally within two to three days).
	2.4 EXAMINING FOR TECHNICAL PERSONNEL: Laboratories are concerned that Interagency Boards of Examiners might not provide the quality and timeliness of service of the Boards of Examiners they replaced.	CSC Labs	Problems have been, or are in the process of being, resolved at the laboratory—CSC regional office level. Any new problems should be brought to the attentionof the servicing Interagency Board or the appropriate CSC regional office.

Problem	Action Agent	Recommended Action
2.4 EXAMINING FOR TECHNICAL PERSONNEL (continued)		
Laboratories are concerned with the timeliness of their appointment offers during the recruiting visits to college campuses. They want to be able to make on-the-spot offers of appointment to quality candidates, in particular, during their visits.	Labs	Procedures exist which permit laboratory recruiters to make on-the-spot commitments to prospective candidates in shortage categories. Laboratory recruiters can be trained and designated as Board agents if the authority is needed. Laboratories should communicate with their Interagency Boards.
2.5 RECRUITING FOR SUMMER WORK: The current requirement that summer hires count under the regular laboratory personnel ceiling, plus the fact that the 30 June date for reporting agency on-board personnel strength figures comes in the midst of the influx of summer employees and June graduates, restricts the summer employment of students.	DoD Army Navy AF	The OSD and the Departments should provide relief either by the OSD's getting the Bureau of the Budget's approval of a more flexible personnel accounting procedure or by the Departments' allowing the laboratories to go over ceiling temporarily during the June-July period, making offsetting ceiling adjustments at other activities that are less subject to the influx of new employees.
The certification dates are too late in the school year to allow for appointment and security clearance procedures.	CSC	The 1968 summer employment examination schedule has been moved back as suggested. Rosters will be made available to agencies by 1 March 1968.
Laboratories desire to hire, on a noncompetitive basis, students who were summer employees the year before.	CSC	Provisions for continuity of employment (reemployment of former student workers) would require changes in the present examining system by the Civil Service Commission. The Commission will investigate the matter.
Difficulty was experienced in reaching science students on certificates.	Labs	Laboratories should explore selective certification procedures (for applicants with science backgrounds) and zone or area certification, where distance, housing, etc., are factors, with the appropriate Interagency Board.
Laboratories do not have the authority to apoint noncompetitively finalists in regional and area scientific competitions to GS-2 summer positions, as can now be done for national finalists.	CSC	The authority to give national science contest finalists excepted appointments without examination was limited to the 1967 summer employment period. Action to reinstate the authority and expand its use to regional or area finalists would require CSC action. The Commission will investigate the matter.

Problem	Action Agent	Recommended Action
2.5 RECRUITING FOR SUMMER WORK (continued)		
Isolated laboratories have difficulty in filling summer positions because housing is not available for applicants from other areas, local applicants frequently are difficult to reach on the register, and sons and daughters of military and civilian personnel have been excluded.	Labs	Proposals to develop an appointment system for summer employment (outside the Summer Employment Examination) have been considered and found to be impracticable. However, the regulations have been changed (1) to permit hiring sons and daughters of military and civilian personnel when jobs are filled through an examination and the student stands highest on the appointment register and (2) to provide increased flexibility in certification of eligibles.
3.1 CLASSIFYING LABORATORY POSITIONS: Representatives of several Army laboratories stated that TDA controls precluded the use of multidisciplinary positions.	Army	Army Headquarters personnel stated that it was not intended that TDA procedures preclude the establishment of interdisciplinary positions. The Department of the Army should remove any existing restrictions on establishing and using interdisciplinary positions; laboratory managers and personnel officers should be so informed.
Representatives of several Army and Air Force activities stated that they have had difficulty in arriving at the proper grade levels for nonresearch engineering positions.	Army AF	The Departments of the Army and the Air Force should review the position structure of the organizations in question to determine (1) the adequacy of position structure in terms of missions, (2) the correctness of classification of key positions, (3) the need for interpretive material for base classification personnel, (4) the use of existing flexibilities, and (5) the need for change in existing classification standards.
3.2 APPLICATION OF THE ENGINEER EQUIVALENCY TEST: The use of state boards of registration to obtain professional status for engineers is too slow (in Massachusetts). The laboratory recommended that the Commission's Engineer Equivalency Examination be reinstated.	CSC	This problem is under active consideration by the Civil Service Commission.
3.3 APPLYING THE CRITERIA FOR QUALITY COLLEGE GRADUATES: The present criteria for quality college graduates are too restrictive and too difficult to apply.	CSC	The Commission will review the recommendations to broaden the quality-graduate concept for M.S. and Ph.D. candidates.

Problem	Action Agent	Recommended Action
3.4 DIVERSE WAGE RATES: Diverse wage rates for similar wage board positions within a commuting area lead to movement of employees from one activity to another.	CSC	The Civil Service Commission has developed a coordinated Federal wage system which will provide uniform rates of pay in all Federal agencies for trades and labor employees performing similar work in the same local wage area. Implementation of the system should resolve most of the problems raised during the meetings.
3.5 APPLYING THE COMMISSION'S SUITABILITY STANDARDS: In order to extend the base of applicants, Civil Service Commission Suitability Standards for appointees have been broadened. In some laboratories, all or most positions require noncritical-sensitive security clearances. As a result, persons are referred on certificates of eligibles who cannot be given the necessary security clearance.	Labs	Laboratories should make greater use of the present Civil Service Commission regulations that permit passing over applicants who cannot be given necessary security clearance when cause is shown.
3.6 USE OF THE COMMISSION'S QUESTIONNAIRE IN EXAMINING FOR UNGRADED POSITIONS: The value and ease of use of the Questionnaire for Ungraded Positions (*Civil Service Handbook* X-118C) was questioned.	CSC	The Civil Service Commission will review the continued use of the questionnaire.
3.7 TRAINING FOR AGENCY RECRUITERS: Laboratory representatives expressed a need for intense, short-term training of technical personnel who recruit new employees.	Labs	Laboratories desiring this service should communicate with the Commission's Bureau of Recruiting and Examining (Mr. Allan W. Howerton) if located in the Washington area. Others should communicate with their Interagency Boards or CSC regional offices.
3.8 CONFLICT OF INTEREST REGULATIONS: Navy laboratories have had difficulty in administering conflict of interest regulations. Employee morale has been adversely affected.	Navy	Recent modifications to the regulation should meet most of the objections. The Department of the Navy should determine whether a significant problem remains and, if so, should present the matter to the Civil Service Commission.

APPENDIX II

OPTION II--DEFENSE R&D AGENCY

With this approach, a Defense R&D Agency (RADA) would be established, consisting of an Office of Defense Research and 8 to 10 centers tailored along mission or functional lines. The Agency would be headed by an executive-level civilian scientist or engineer.

RADA would be manned principally by civil service personnel. with a heavy sprinkling of technically trained officers flowing through the organization. This would provide some military operational insight and a source of R&D training for these officers. Also, by using tours of duty, civilians from within government and from industry and universities should be brought into RADA for specified periods of time to continually bring new ideas and concepts into the organization.

In creating RADA, only those Defense laboratories that meet rigid criteria of quality should be absorbed. If it were necessary to establish a high-priority function in RADA and no competent Defense laboratory existed, an entirely new organizational element should be created.

If a decision were made to transfer an existing Defense laboratory into RADA, that laboratory should continue in its current geographical location in order to eliminate the need for massive military construction. Over the years, however, an attempt should be made to recombine elements of centers and laboratories more centrally.

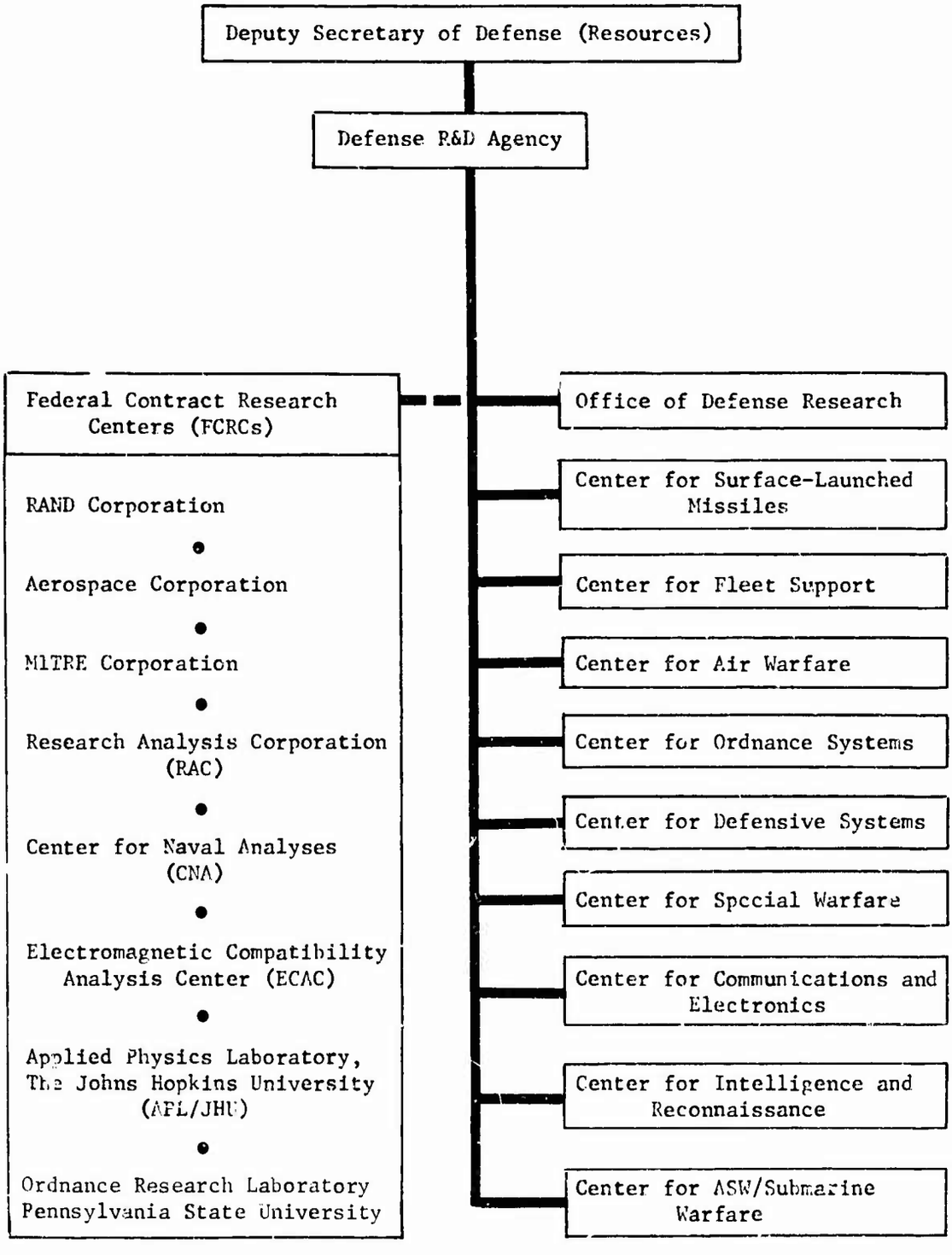
1. Office of Defense Research

The Office of Defense Research (ODR), which could be the principal, or "corporate," research arm of the DoD, would be created from the Military Departments' R&D offices and laboratories. The ODR would be the DoD's chief interface with the scientific community, both as a sponsor of long-range research and as the headquarters office of a high-quality in-house research operation.

Initially formed from the Office of Naval Research, the Air Force Office of Scientific Research, and the Army Research Office at Durham, North Carolina, the ODR would be assigned the mission of supporting high-quality research in the biological, physical, engineering, social and behavioral sciences. Three major research laboratories would be assigned to it--the Naval Research Laboratory, the Air Force Cambridge Research Laboratories, and the Air Force Aerospace Research Laboratories.

Because most areas of technology and weaponry are broadly concerned with materials, the Army Materials and Mechanics Research Center and the Air Force Materials Laboratory would be combined to form a new Defense Materials Laboratory reporting to the ODR. ARPA's materials research program, together with its interdisciplinary laboratories, would also be transferred to this office.

Figure II-1. Organization of Defense R&D Agency



A new and entirely separate center or laboratory concentrating on human performance, selection, training and evaluation could be established under the ODR to give the area a needed shot in the arm. Existing DoD laboratories in this field would remain within the Military Departments to work on shorter term military manpower problems.

To assure balanced scientific coverage, a small medical research laboratory should report to the ODR. The Armed Forces Radiobiology Institute of the Defense Atomic Support Agency, with a broadened research mission, would be considered a candidate laboratory for this assignment.

2. RADA Centers

The remainder of the centers making up the Defense R&D Agency could consist of functionally oriented, full-spectrum organizations structured to satisfy the highest priority needs of the DoD. Examples of possible centers are described briefly below, and their organizational relationships are summarized in Figure 1.

(1) Center for Surface-Launched Missiles

Mission: R&D in the general field of offensive strategic and tactical systems and subsystems; also, R&D in support of the Defense space program in systems, subsystems and technology.

Organization: The nucleus of this Center could consist of the Army Missile Command Laboratory, the Air Force Rocket Propulsion Laboratory and the Air Force Weapons Laboratory.

(2) Center for Fleet Support

Mission: R&D in ship systems, amphibious warfare, naval guns, torpedoes, mines and other types of naval ordnance.

Organization: Elements of the Naval Ships R&D Center, the Naval Ordnance Laboratory (White Oak, Maryland) and the Naval Weapons Laboratory (Dahlgren, Virginia) could constitute the basic make-up of this Center.

(3) Center for Air Warfare

Mission: R&D on tactical aircraft systems, including air munitions, tactical missiles and armament for air-to-air and air-to-ground weapon systems.

Organization: The Naval Weapon Center (China Lake, California) would be the principal organization making up this Center, with some augmentation from the Air Force's Aeropropulsion, Avionics and Flight Dynamics Laboratories, plus elements of the Army Air Mobility Center.

(4) Center for Ordnance Systems

Mission: R&D on guns, ammunition, explosives, warheads, fuzes, land mines, land combat and support vehicles--excluding air and sea weapons.

Organization: The Harry Diamond Laboratories and the Army Ballistic Research Laboratories could be the nucleus of this Center, around which the organization should be established.

(5) Center for Defensive Systems

Mission: R&D for defense against attack by aircraft, missiles or space-based systems, including land-based antiaircraft and antimissile systems.

Organization: A Center of this nature would have to be created, since the associated expertise is scattered within the DoD.

(6) Center for Special Warfare

Mission: R&D in the areas of limited war, counterinsurgency and riot control.

Organization: A totally new organization would have to be established for this purpose.

(7) Center for Communications and Electronics

Mission: R&D in the areas of communications, command and control, electronic devices such as radar, electron optics, computers and data processing, and related technologies.

Organization: Elements of the Army Electronics R&D Laboratories, the Navy Electronics Laboratory Center, and the Air Force Rome Air Development Center could provide a nucleus for this Center and for the Center for Intelligence and Reconnaissance (item 8).

(8) Center for Intelligence and Reconnaissance

Mission: R&D in the areas of reconnaissance, battlefield intelligence, and passive and active electromagnetic warfare.

Organization: As in the case of the Center for Communications and Electronics, elements of the Army Electronics R&D Laboratories, the Navy Electronics Laboratory Center, and the Air Force Rome Air Development Center could provide a nucleus for this Center.

(9) Center for ASW/Submarine Warfare

Mission: R&D in the general field of antisubmarine (ASW) and submarine warfare, including air, surface and subsurface systems and ocean surveillance.

Organization: Elements of the Naval Undersea R&D Center (San Diego, California), the Naval Air Development Center, and the recently formed Naval Underwater Systems Center could form the basis for this center.

3. Government-Owned, Contractor-Operated Activities

In addition to managing the in-house centers, RADA would administer the contractors for the principal FCRCs, either for its own purposes or for those of the various other DoD elements. This would ensure a uniform policy of FCRC management, and would integrate the findings and analyses of both the in-house and the contractor organizations.

APPENDIX III

PROPOSED GOVERNMENT INSTITUTES ACT

Prepared by

the Bureau of the Budget

2 October 1962

DRAFT
10/2/62

GOVERNMENT INSTITUTES ACT

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That this Act may be cited as the "Government Institutes Act of 19__.". . .

Sec. 2. The President, when authorized in an appropriation or other Act, may establish one or more Institutes for the purpose of conducting, fostering, or assisting in research, development, investigations, experiments, and studies relating to the national interest, defense, and security.

Sec. 3. (a) Subject to the direction and control of the President, or the head of such department or agency as he may designate, any Institute established under this Act shall be a body corporate governed by a Board of Regents (hereinafter referred to as a "Board") consisting of such department or agency head, or his designee, ex officio, and six members who shall be appointed from private life by the President or designated by the President from among the officers and employees of the United States Government : Provided, That no more than three members shall be so designated. The appointed members shall be persons eminent in the fields of basic science, engineering, research administration, education, or public affairs and shall be selected solely on the basis of established records of distinguished service. The President shall select the Chairman of the Board. Four of the members of a Board shall constitute a quorum.

(b) Members of a Board appointed from private life may be compensated at a rate determined by the President, but not to exceed $75 per diem, and all members of the Board may be paid travel expenses and per diem in lieu of subsistence in accordance with the provisions of section 5 of the Administrative Expenses Act of 1946, as amended (5 U.S.C. 73b-2).

Sec. 4. (a) Any Institute created under the authority of this Act shall have an Executive Director (hereinafter referred to as the "Director") who shall be appointed by the President and who shall be the chief executive officer of the Institute. Before any person is appointed as Director the President shall afford the Board an opportunity to make recommendations to him with respect to such appointment.

(b) The Director shall receive compensation at a rate to be prescribed by the Board, subject to the approval of the President, without regard to the Classification Act of 1949, as amended.

Sec. 5. Each Institute established under this Act shall have its organization, powers, functions, and duties set out by the President in

a charter which shall be published in the Federal Register. When so authorized by its charter, an Institute shall have the authority to:

(a) Adopt, alter, and use a corporate seal.

(b) Adopt, amend, and repeal by-laws, rules, and regulations governing the conduct of its business and the performance of the powers and duties granted to or imposed on it by law and by the charter under which it is established.

(c) Acquire in any lawful manner, any property, real, personal, or mixed, tangible or intangible, or any interest therein; to hold, maintain, use, and operate the same; to provide services in connection therewith, and to charge therefor; and to sell, lease, or otherwise dispose of the same at such times, in such manner, and to the extent deemed necessary or appropriate to carry out the purpose of the Institute: Provided, That such disposition shall be made in accordance with the Federal Property and Administrative Services Act of 1949, as amended. Proceedings for condemnation shall be instituted pursuant to the provisions of the Act approved August 1, 1888, as amended (40 U.S.C. 257), and section 1403 of Title 28, United States Code. The Act approved February 26, 1931, as amended (40 U.S.C. 258a), shall be applicable to any such proceeding. All real property acquired under this Act shall be subject to the provisions of section 355 of the Revised Statutes, as amended (40 U.S.C. 255).

(d) Accept gifts or donations of services, money or property, real, personal, or mixed, and invest or reinvest the proceeds therefrom in interest bearing obligations of the United States or in obligations guaranteed as to both principal and interest by the United States. Such gifts or donations and the income from such investments shall be available for the payment of all expenditures of the Institute unless restricted by the donor to a particular purpose or objective: Provided, That no restricted gift or donation shall be accepted which is inconsistent with its charter.

(e) Enter into and perform such contracts, leases, cooperative agreements, or other transactions as may be necessary in the conduct of its business and on such terms as it may deem appropriate, with any agency or instrumentality of the United States, or with any State, territory, or possession, or with any political subdivision thereof, or with any person, firm, association, or corporation; make partial and advance payments under such transactions; and make available in connection therewith such of its equipment and facilities as it may deem desirable.

(f) Sue or be sued in its own name: Provided, That nothing in this Act shall be construed to exempt an Institute or its operations from the application of sections 507(b) and 2679 of Title 28, United States Code, or of section 367 of the Revised Statutes (5 U.S.C. 316).

(g) Subject to the Civil Service laws, select, appoint, employ, vest with powers and duties, and, subject to such regulations as the President may prescribe and without regard to the Classification Act of 1949, as amended, fix and adjust, at rates which are reasonably competitive with prevailing rates paid by non-Federal employers for comparable work, compensation of such officers, attorneys, and employees as may be necessary to carry out the functions of the Institute.

(h) Appoint such advisory committees as may be appropriate in the performance of the functions of the Institute.

(i) When determined by the Director to be necessary and subject to such security investigations as he may determine appropriate, employ aliens without regard to statutory provisions prohibiting payment of compensation to aliens.

(j) Employ and compensate retired members of the uniformed services of the United States at the rate established for the positions so occupied by them in the Institute, but, during the period in which they occupy such positions, their retired, retirement, or retainer pay shall be reduced to an annual rate equal to the first $2,000 of such retired pay plus one half of the remainder, if any: Provided, That the President may prescribe exceptions to such restrictions whenever he determines they are warranted on the basis of special Government employment needs which cannot otherwise be readily met.

(k) Settle and adjust claims held by it against other persons or parties and by other persons or parties against the Institute.

(l) Determine the character of and the necessity for its obligations and expenditures, and the manner in which they shall be incurred, allowed, and paid, subject to the provisions of law specifically applicable to Government corporations.

(m) Execute, in accordance with its by-laws, rules, or regulations, all instruments necessary or appropriate in the exercise of any of its powers.

(n) Accept and utilize, with the consent of the head of the department or agency concerned, the services, equipment, personnel, and facilities of any department or agency of the Federal Government with or without reimbursement, and on a similar basis to cooperate for their mutual benefit with other public and private agencies and instrumentalities in the use of the services, equipment and facilities of the Institute.

(o) Charge for its services, facilities and property, and be credited with the receipts therefrom. Such receipts shall be available for the payment of all expenditures of the Institute.

(p) Take such actions as may be necessary or appropriate to carry out the powers herein or hereafter specifically conferred upon it.

Sec. 6. Funds, facilities, equipment, personnel and other assets available to any agency or instrumentality of the United States shall be available for transfer, with the approval of the head of the department or agency involved, in whole or in part, to an Institute for such use as is consistent with the purposes for which they were provided.

Sec. 7. Such sums as may be required for the carrying out of the functions of any Institute established under this Act are hereby authorized to be appropriate without fiscal year limitation.

Sec. 8. The Government Corporation Control Act, as amended, is amended by adding thereto a new Title IV, entitled 'Government Institutes," and providing as follows:

"Sec. 401. Any Institute established pursuant to the Government Institutes Act of 19__ shall be considered a wholly-owned Government corporation within the meaning of this Act: Provided, That, whenever it is deemed by the President to be practicable and in the public interest, he may provide that an Institute be treated with respect to its budget, appropriations, expenditures, accounting and other fiscal matters as if it were a Government agency other than a corporation."

Sec. 9. If any provisions of this Act or the application of such provisions to any person or circumstances shall be held invalid, the remainder of the Act and the application of such provisions to persons and circumstances other than those to which it is held invalid shall not be affected thereby.

APPENDIX IV

BASIC REQUIREMENTS FOR MAXIMIZING EFFECTIVENESS

Extracted from Operation and Management of R&D Facilities and Programs, Analytical and Advisory Services and Technical Supervision of Weapon Systems and Other Programs, Report of the Bureau of the Budget, prepared by H. Holst, et al., 17 April 1962.

VIII. BASIC REQUIREMENTS FOR MAXIMIZING EFFECTIVENESS

As stated above, the resources of the nation available for research and development are extremely limited. From this scarce resource must flow the continuing stream of new products and processes required to meet the nation's expanding needs and to provide a rising standard of living. In a world of increasing freedom of trade, the ability of this country to compete with others whose labor costs are lower, plants or equipment newer or more efficient, or which possess natural advantages of proximity to raw materials or the like, is very dependent upon the creative role of progressive management of R & D, technological innovation, cost reduction, and increased productivity. The resources capable of making such contributions must be husbanded and must be used efficiently if they are to provide both for the nation's civilian requirements, the promotion of public health, maximum effectiveness in defense, conquest of space, and world betterment through A.I.D. and international cooperation. What then are the conditions required for maximizing the effectiveness of this talent and these resources of the country? Because of the importance of this aspect, it seems worthwhile to deal with it in some detail. The elements may perhaps be summarized under the following captions:

(1) Reputation and Atmosphere
(2) Excellence of Staff and its Direction
(3) Importance of Facilities and Support
(4) Clarity, Challenge and Urgency of Objectives
(5) Maintenance of Professional Caliber of Operations
(6) Professional Leadership by Professionals
(7) Professional Recognition and Encouragement
(8) Encouragement and Support of Freedom of Iniquiry and Method
(9) Advancement on Merit
(10) Absence of Unproductive Regulations and Reports

(1) Reputation and Atmosphere. Essential to the recruitment, maintenance and stimulation of professional staff is the existence and preservation of a reputation for high grade professional work in an atmosphere and environment of accomplishment. The existence of such a reputation, and the knowledge that such an environment exists in an organization, are its best attractions for securing staff of unusual competence. It is essential, therefore, that to maximize its effectiveness an organization do its utmost to achieve such a reputation and to maintain such an atmosphere. This imposes many requirements, including rigorous adherence to a policy of undertaking only such work as the organization can do well. Likewise, it is dependent upon maintaining an atmosphere of professional freedom and the expectancy of professional contribution. Obviously, such an environment is not created by rules and regulations based on distrust or suspicion.

(2) Excellence of Staff and Direction. Since the type of service sought by the Government, and considered in this report, is wholly dependent upon the personal service and creativity of individuals, it is impossible to over-emphasize the importance which must be attached to attracting staff of the highest competence. Equally important is the managerial and administrative skill of personnel responsible for these aspects of operation.

Experience over the years, and in many organizations, has established that the recruitment and leadership of truly creative talent is an intricate and, as yet, not fully understood mixture of art and science. Since the components most essential to success are people, and these are frequently highly individualistic and of unique and unorthodox characteristics, a prime requirements is the ability to accept and utilize staff of unusual characteristics. It does not follow, that every individual who wears a beard, or appears beatnik is necessarily an effective worker. Effective administration and direction are therefore always essential.

Of early and prime importance to fruitful work are penetrating problem analysis and the method of approach employed. Fundamental requirements must be analyzed with utmost skill and programs of effort designed with knowledge of past experience and the existing state of the applicable arts and sciences, and also with appreciation for areas in which little is known. Problem analysis and program design of this kind call for personnel of unusual qualifications, obviously in great demand and short supply. As stated before, essential to the effective use of such individuals are operating policies of unusual flexibility. But, in proportion to the degree of freedom and flexibility, is the need for skillful leadership. It falls upon the laboratory director and section heads continually to keep effort in promising areas and to inspire personnel to see true professional challenge in the problems assigned. Only in this way can creative concepts be stimulated to achieve required penetration of analysis and synthesis of concepts to create advanced, significant solutions. As stated, for maximum effectiveness this type of operation requires basic freedom and flexibility under skilled direction which is at variance with rigidities imposed from the outside.

(3) Importance of Facilities and Support. In recent years, and with the progress of research into ever more esoteric spheres, the importance and cost of supporting services and the requirement for extremely expensive and unique equipment has increased. Under these conditions it becomes all the more necessary that workers on advanced projects have ready access to existing facilities or can share existing facilities without incurring the loss of time and added costs which would follow from the building of new teams and the provision of separate facilities. Obviously, it is of help if the establishments employed already make use of a network of working relationships with other organizations and their personnel to provide specialized skills and special equipment as needed for any given phase of the work. For some projects the availability of field service engineers or facilities likewise becomes a requirement.

(4) Clarity, Challenge and Urgency of Objectives. Of importance to the success of undertakings, particularly those involving creative effort, is the clarity with which problems to be undertaken are analyzed. It then becomes necessary to express the basic requirements with challenge and urgency to the professional and supporting staffs. This is the role of skilled direction. It is a function recognized and appreciated by all able administrators and leaders. It is of particular importance and application to the work of organizations depending upon professional staffs which attach great importance to their personal freedom and to their involvement in fields of professional interest. It is the skill of the leadership in presenting the problems worked upon by the organization with clarity, challenge and persuasion which will stimulate and keep the staff applied to difficult undertakings with the greatest hope of successful outlook. Clearly this kind of operation is not achieved by the imposition of external regulations but must come from the inherent caliber and interest of the organization.

(5) Maintenance of Professional Caliber of Operations. If an organization has attracted outstanding professionals and desires to keep and use them effectively, it is essential that the operations of the organization be maintained at a high professional caliber. Only in this way will it be possible to elicit from the staff their best efforts and to maintain continuity of effort at the highest possible level. The ways in which this is accomplished are varied and include many forms of indirect action, such as the promotion of internal instruction, seminars, discussion groups, and attendance at professional training establishments, both recognized outside educational institutions and other agencies. The requirement for flexibility in the use of staff time for these purposes, many of which may seem not directly applicable to the immediate objectives, requires considerable freedom and flexibility of operation which is in contrast to the regimentation likely to result under Government regulations.

(6) Professional Leadership by Professionals. More than in other fields, professionals who seek constantly to improve their own stature desire leadership by professionals whom they respect. By this means they hope at the same time to learn and to receive recognition. It is the experience of organizations using such personnel that staff productivity is increased, and staff satisfaction enhanced when the professional activities are led by professionals who remain with the organization for substantial periods and thus both understand its requirements and are recognized by the staff as understanding these requirements. This is the contrary of the frequent rotation of military officers through Government establishments.

(7) Professional Recognition and Encouragement. In organizations depending for their success upon high caliber professional staff, it is essential that professional performance be recognized by professionals who can genuinely appreciate the contribution made by a staff member. The standing of an individual with his colleagues is of enormous importance and stimulus. The end result of working in an

environment needed for effective professional performance. Recognition by merit and on a purely professional basis, without relationship to number of subordinates administered, is not readily achieved.

(8) Encouragement and Support of Freedom of Inquiry and Method. Much has been said in preceding sections regarding the essential need for the encouragement and support of creativity. Clearly, the most effective and valid form of support is the actual operation of the organization. As pointed out, professional leadership and professional recognition are necessary components in this environment. The presence of good work and effective leadership are convincing and contagious. The true spirit of an organization and its sincere backing of creative effort will also be evidenced by the extent to which the organization supports self-sponsored programs of investigation and afford time, funds and facilities for these purposes. In this way members of the staff and the organization as a whole demonstrate encouragement and support for freedom of inquiry and in turn are rewarded with the results of these investigations and training. The freedom required for this method of operation is demanding, demanding on the professional of good use of his time, demanding on the administrator to keep work moving forward. This kind of freedom and responsibility is not readily achieved and does not result merely by the imposition of rules.

(9) Advancement on Merit. Essential to continued effort, and particularly to zealous effort, is evidence that meritorious effort will be recognized and rewarded. While words of commendation are necessary and valuable, they are not as convincing as tangible progress in the organization. Such progress should take the form of increases in compensation and promotion in position. It is essential that these advances be truly based on merit. This form of recognition will make major contributions to the effectiveness of the organization and its staff. It is difficult to administer. Its application cannot be achieved merely by imposed procedures. It must come from fundamental characteristics of the organization and staff.

(10) Absence of Unproductive Regulations and Report Requirements. It is well known that professionals greatly dislike and complain about red tape and paperwork. Timely and reasonable reporting requirements and rational justification of requests are necessary and can serve to demonstrate to the staff that efficiency and performance is required. However, it is certain that excessive reporting and justification requirements will prove unpleasant to a high grade professional staff and will cause loss of favorable features in the organization's environment and consequent reduction in its productivity. It is perhaps as much in the area of unproductive regulations and excessive reports as in any other aspect that Government organizations are likely to suffer by comparison with private enterprise. It is believed that this feature contributes in no small degree to the difficulty of the Government in recruiting and maintaining superior personnel in its organizations.

APPENDIX V

GOALS AND OBJECTIVES FOR DEFENSE LABORATORIES

Extracted from "Policy Guidance Regarding the In-House Laboratories," unpublished paper prepared by E. D. Anderson for the Office of the Director of Defense Research and Engineering, 1 September 1970.

Goals and Objectives for Defense Laboratories

The security and survival of the country depends to a major degree upon our technological capability. At a time when the U. S. R&D effort is declining, the Soviet effort is increasing to the degree that they may achieve broad technological superiority by the end of the decade. Although major efforts are being made to increase the U. S. R&D effort to guard against technological surprise and to be able to develop the weapons when needed, the probability of changing the funding trend is doubtful, at least in the next few years. Thus it becomes imperative to seek means to make our RDT&E efforts as efficient and effective as possible.

The in-house laboratory operations utilize about 15 percent of the RDT&E dollar annually. They represent a major investment in funds, people and facilities. It is essential that they be managed judiciously, not only for this reason but also because they impact strongly on the other aspects of Defense RDT&E effort. In the current environment, it is important that we understand what is expected of each other, as well as what is expected of the in-house laboratories. Accordingly, the following paragraphs are designed to state clearly the DoD policies, expectations and objectives relating to Government-owned, Government-operated (in-house) laboratories.

Goals of the In-House Laboratories

This decade may well be one of the most critical in the history of the world. Hopefully, it will be the time when world peace is finally achieved, but it may also be the time of new confrontations. Whatever the challenge, we must be prepared to meet it in terms of its impact on our mission responsibilities. We must have firm goals and clear objectives. In terms of our in-house laboratories, our goals will be to:

(1) Mold and maintain a viable laboratory system with the ability to conceive and develop, or manage the development of, advanced weapon systems in response to military needs.

(2) Maintain functional competence during peacetime, as well as during times of conflict, in those areas of technology peculiar to military needs.

(3) Develop and maintain in-house technical skills capable of defining DoD requirements for contractors, and also provide the ability to monitor and assess the accomplishments of DoD contractors while remaining relatively free of external political, social and economic pressures.

(4) Provide the Military Services with a fast reaction capability to solve critical immediate problems that arise in connection

with existing operational weapon systems, or when unexpected combat situations are encountered;

(5) Probe and exploit the frontiers of knowledge for new military capabilities beyond established requirements.

Management Policies

The Military Departments must use the in-house laboratories in key roles with respect to shaping and administering the complex RDT&E programs of the future. Their contributions therefore must be of the highest quality. They must be given expanded roles which will involve them more heavily in the overall weapon planning process and in urgent military problems. They will be expected to:

(1) Understand and define overall system problems;

(2) Work jointly with military planners to define crucial military requirements based upon critical assessment of existing and predicted technology;

(3) Provide, within assigned mission areas, military and technical concepts that could serve as the basis for long-range programs in research and exploratory development;

(4) Conduct sufficient technical work in-house to ensure that specifications for systems can be developed with confidence, and serve in the evaluation, assistance and day-to-day direction of the work of other organizations engaged in systems or technology development;

(5) Furnish consulting support to project managers when a commitment is made to undertake a major program development;

(6) Furnish technical support to industry as required in the production phase.

It is DoD policy to provide as much strength and flexibility in our laboratory system as possible through the delegation of the prerequisite authorities and responsibilities. In turn, the laboratories are expected to work effectively, singly and together, to provide a firm technological base for meeting future military needs. Their contributions and products must be timely, of the highest quality, and must satisfy a military need. Laboratories which become obsolete through loss or deletion of mission, or become unproductive owing to stagnation or marginal leadership, will be either revitalized, consolidated with other activities, or eliminated. Periodic evaluations to assess the performance and need for each activity will be required.

Organization

Shrinking budgets, coupled with increasingly more complex weapon systems, dictate a need for greater organizational efficiency and flexibility. We cannot afford the luxury of layered command structures. Organizations must provide simple and direct lines of communication, authority and responsibility from the highest to the lowest levels. We must continue to direct efforts toward eliminating small, fragmented organizations and the establishment of major centers capable of taking on the larger, more complex problems of the future and of accommodating the work of more than one Service. Cumbersome and restrictive organizational procedures, controls or administrative devices not suited to research and development activities must be streamlined or eliminated.

Good organizational development means good planning. Organizational goals or objectives must be clearly identified and the path to achievement plotted as specifically and quantitatively as possible.

People

The key to the success or failure of an organization is usually found in the people in it. If they are highly motivated, creative and enthusiastic, they will generally combine to form a winning team. These are the types of people we want in our in-house laboratories. To achieve this, we must do two things. We must select only the most skillful managers for the top-level positions in the laboratories, and we must provide them with maximum administrative flexibility. The laboratories must be staffed with creative and talented people in an atmosphere of professional freedom and expectancy of professional contribution.

Management at all levels must be familiar with personnel policies and procedures in order to make the most of the flexibility available within the system. Laboratory managers must be stimulated to try new concepts and new approaches to solving the old personnel and administrative problems. We must establish new goals, incentives and rewards for good management.

Greater mobility of people must be exercised, and more clearly defined career channels developed. The success of industry lies in large part in its flexible personnel practices. Since this is one of the major impediments to achieving maximum efficiency of the in-house laboratories, we must give it major attention. It is incumbent upon laboratory managers to replace attitudes of complacency and resignation with those of initiative and vigor in attacking and solving these problems. However, the assistance of top management in providing new tools is an essential ingredient also.

Facilities

The problem of providing adequate facilities for performing R&D continues to plague the DoD year after year because of its complex economic, political and social impact. We must concentrate on that portion of the problem over which we have direct control, that is, in the planning for facilities. It is the responsibility of each laboratory manager to prepare and keep current a long-range facilities plan, and it is incumbent upon each Military Department to prepare and keep current a long-range institutional plan. The long-range institutional plans will form the basis for preparing each year's military construction program.

Program

The purpose or mission of a laboratory establishes the broad program parameters within which the laboratory will operate in terms of weapon systems and/or technological fields. Management at all levels, however, must assure that:

(1) The laboratory is not captive to middle management, tasked by them on a "job shop" basis.

(2) The laboratory is involved in a responsible way in important system development decisions, in requirements, concept formulation and evaluation. Assignment of high-priority programs to laboratories will assure greater responsiveness and productivity.

(3) Each laboratory has a strong central, or core, program representing about 20 to 50 percent of the laboratory's total program in research, exploratory development and advanced development, with the remaining effort obtained from sponsors in an environment of competition.

(4) Each laboratory operates in an effective cost-conscious manner, adopting wherever possible the best methods utilized by private enterprise.

(5) Each laboratory maintains a proper program balance between its in-house and out-of-house work.

Interrelationships

The in-house laboratories cannot view themselves as autonomous bodies. They are dependent on sponsors and/or customers and as such must strive to satisfy their particular needs.

As indicated earlier, the in-house laboratories represent only one performer, but they have ties and responsibilities to other performers such as industry, universities and nonprofit organizations. The in-house laboratories must strive to maintain, whenever possible, a close contract or working relationships with the scientific community and an expanding out-of-house effort with industry as ideas progress through the development cycle.